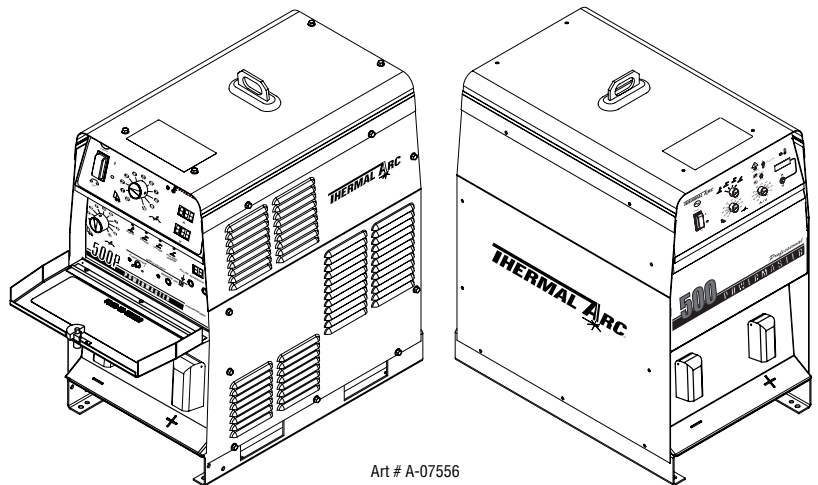




350
350P
500
500P

POWERMASTER

CC/CV POWER SOURCE



Art # A-07556

Service Manual

Revision: AD

Issue Date: March 17, 2006

Manual No.: 0-4938B

Operating Features:

Operating Features:							208 V	230 V
 GMAW FCAW	 MMAW	 GTAW	500 AMP	CC CV	DC	3 PHASE	460 V	400 V

WARNINGS

Read and understand this entire Manual and your employer's safety practices before installing, operating, or servicing the equipment.

While the information contained in this Manual represents the Manufacturer's best judgement, the Manufacturer assumes no liability for its use.

Power-Master Inverter Welding Power Supply

Service Manual Number 0-4938B for:

Power-Master 500 Part Number 100060, 100095 (CCC)

Power-Master 500P Part Number 100054, 100096 (CCC)

Power-Master 350 Part Number 100078, 100101 (CCC), 100099 (CSA)

Power-Master 350P Part Number 100079, 100102 (CCC), 100100 (CSA)

Published by:

Thermadyne Industries, Inc.

82 Benning Street

West Lebanon, New Hampshire, USA 03784

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Original Publication Date: March 17, 2006

Revision AC Date: October 30, 2008

Record the following information for Warranty purposes:

Where Purchased: _____

Purchase Date: _____

Equipment Serial #: _____

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LIMITED WARRANTY

WARRANTY SCHEDULE

GLOBAL CUSTOMER SERVICE CONTACT INFORMATION Inside Rear Cover

SECTION 1: SAFETY INSTRUCTIONS AND WARNINGS



WARNING

PROTECT YOURSELF AND OTHERS FROM POSSIBLE SERIOUS INJURY OR DEATH. KEEP CHILDREN AWAY. PACEMAKER WEARERS KEEP AWAY UNTIL CONSULTING YOUR DOCTOR. DO NOT LOSE THESE INSTRUCTIONS. READ OPERATING/INSTRUCTION MANUAL BEFORE INSTALLING, OPERATING OR SERVICING THIS EQUIPMENT.

Welding products and welding processes can cause serious injury or death, or damage to other equipment or property, if the operator does not strictly observe all safety rules and take precautionary actions.

Safe practices have developed from past experience in the use of welding and cutting. These practices must be learned through study and training before using this equipment. Some of these practices apply to equipment connected to power lines; other practices apply to engine driven equipment. Anyone not having extensive training in welding and cutting practices should not attempt to weld.

Safe practices are outlined in the American National Standard Z49.1 entitled: SAFETY IN WELDING AND CUTTING. This publication and other guides to what you should learn before operating this equipment are listed at the end of these safety precautions. **HAVE ALL INSTALLATION, OPERATION, MAINTENANCE, AND REPAIR WORK PERFORMED ONLY BY QUALIFIED PEOPLE.**

1.01 Arc Welding Hazards



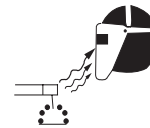
WARNING

ELECTRIC SHOCK can kill.

Touching live electrical parts can cause fatal shocks or severe burns. The electrode and work circuit is electrically live whenever the output is on. The input power circuit and machine internal circuits are also live when power is on. In semiautomatic or automatic wire welding, the wire, wire reel, drive roll housing, and all metal parts touching the welding wire are electrically live. Incorrectly installed or improperly grounded equipment is a hazard.

1. Do not touch live electrical parts.
2. Wear dry, hole-free insulating gloves and body protection.
3. Insulate yourself from work and ground using dry insulating mats or covers.
4. Disconnect input power or stop engine before installing or servicing this equipment. Lock input power disconnect switch open, or remove line fuses so power cannot be turned on accidentally.
5. Properly install and ground this equipment according to its Owner's Manual and national, state, and local codes.
6. Turn off all equipment when not in use. Disconnect power to equipment if it will be left unattended or out of service.

7. Use fully insulated electrode holders. Never dip holder in water to cool it or lay it down on the ground or the work surface. Do not touch holders connected to two welding machines at the same time or touch other people with the holder or electrode.
8. Do not use worn, damaged, undersized, or poorly spliced cables.
9. Do not wrap cables around your body.
10. Ground the workpiece to a good electrical (earth) ground.
11. Do not touch electrode while in contact with the work (ground) circuit.
12. Use only well-maintained equipment. Repair or replace damaged parts at once.
13. In confined spaces or damp locations, do not use a welder with AC output unless it is equipped with a voltage reducer. Use equipment with DC output.
14. Wear a safety harness to prevent falling if working above floor level.
15. Keep all panels and covers securely in place.



WARNING

ARC RAYS can burn eyes and skin; NOISE can damage hearing. Arc rays from the welding process produce intense heat and strong ultraviolet rays that can burn eyes and skin. Noise from some processes can damage hearing.

1. Wear a welding helmet fitted with a proper shade of filter (see ANSI Z49.1 listed in Safety Standards) to protect your face and eyes when welding or watching.
2. Wear approved safety glasses. Side shields recommended.

POWERMASTER 500, 500P, 350, 350P

- Use protective screens or barriers to protect others from flash and glare; warn others not to watch the arc.
- Wear protective clothing made from durable, flame-resistant material (wool and leather) and foot protection.
- Use approved ear plugs or ear muffs if noise level is high.



WARNING

FUMES AND GASES can be hazardous to your health.

Welding produces fumes and gases. Breathing these fumes and gases can be hazardous to your health.

- Keep your head out of the fumes. Do not breathe the fumes.
- If inside, ventilate the area and/or use exhaust at the arc to remove welding fumes and gases.
- If ventilation is poor, use an approved air-supplied respirator.
- Read the Material Safety Data Sheets (MSDSs) and the manufacturer's instruction for metals, consumables, coatings, and cleaners.
- Work in a confined space only if it is well ventilated, or while wearing an air-supplied respirator. Shielding gases used for welding can displace air causing injury or death. Be sure the breathing air is safe.
- Do not weld in locations near degreasing, cleaning, or spraying operations. The heat and rays of the arc can react with vapors to form highly toxic and irritating gases.
- Do not weld on coated metals, such as galvanized, lead, or cadmium plated steel, unless the coating is removed from the weld area, the area is well ventilated, and if necessary, while wearing an air-supplied respirator. The coatings and any metals containing these elements can give off toxic fumes if welded.



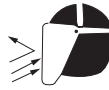
WARNING

WELDING can cause fire or explosion.

Sparks and spatter fly off from the welding arc. The flying sparks and hot metal, weld spatter, hot workpiece, and hot equipment can cause fires and burns. Accidental contact of electrode or welding wire to metal objects can cause sparks, overheating, or fire.

- Protect yourself and others from flying sparks and hot metal.
- Do not weld where flying sparks can strike flammable material.
- Remove all flammables within 35 ft (10.7 m) of the welding arc. If this is not possible, tightly cover them with approved covers.
- Be alert that welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas.
- Watch for fire, and keep a fire extinguisher nearby.
- Be aware that welding on a ceiling, floor, bulkhead, or partition can cause fire on the hidden side.
- Do not weld on closed containers such as tanks or drums.
- Connect work cable to the work as close to the welding area as practical to prevent welding current from traveling long, possibly unknown paths and causing electric shock and fire hazards.
- Do not use welder to thaw frozen pipes.
- Remove stick electrode from holder or cut off welding wire at contact tip when not in use.

Eye protection filter shade selector for welding or cutting (goggles or helmet), from AWS A6.2-73.					
<i>Welding or cutting</i>	<i>Electrode Size</i>	<i>Filter</i>	<i>Welding or cutting</i>	<i>Electrode Size</i>	<i>Filter</i>
Torch soldering		2	Gas metal-arc		
Torch brazing		3 or 4	Non-ferrous base metal	All	11
Oxygen Cutting			Ferrous base metal	All	12
Light	Under 1 in., 25 mm	3 or 4	Gas tungsten arc welding	All	12
Medium	1 to 6 in., 25-150 mm	4 or 5	(TIG)	All	12
Heavy	Over 6 in., 150 mm	5 or 6	Atomic hydrogen welding	All	12
Gas welding			Carbon arc welding	All	12
Light	Under 1/8 in., 3 mm	4 or 5	Plasma arc welding		
Medium	1/8 to 1/2 in., 3-12 mm	5 or 6	Carbon arc air gouging		
Heavy	Over 1/2 in., 12 mm	6 or 8	Light		12
Shielded metal-arc	Under 5/32 in., 4 mm	10	Heavy		14
	5/32 to 1/4 in.,	12	Plasma arc cutting		
	Over 1/4 in., 6.4 mm	14	Light	Under 300 Amp	9
			Medium	300 to 400 Amp	12
			Heavy	Over 400 Amp	14

**WARNING**

FLYING SPARKS AND HOT METAL can cause injury.

Chipping and grinding cause flying metal. As welds cool, they can throw off slag.

1. Wear approved face shield or safety goggles. Side shields recommended.
2. Wear proper body protection to protect skin.

**WARNING**

CYLINDERS can explode if damaged.

Shielding gas cylinders contain gas under high pressure. If damaged, a cylinder can explode. Since gas cylinders are normally part of the welding process, be sure to treat them carefully.

1. Protect compressed gas cylinders from excessive heat, mechanical shocks, and arcs.
2. Install and secure cylinders in an upright position by chaining them to a stationary support or equipment cylinder rack to prevent falling or tipping.
3. Keep cylinders away from any welding or other electrical circuits.
4. Never allow a welding electrode to touch any cylinder.
5. Use only correct shielding gas cylinders, regulators, hoses, and fittings designed for the specific application; maintain them and associated parts in good condition.
6. Turn face away from valve outlet when opening cylinder valve.
7. Keep protective cap in place over valve except when cylinder is in use or connected for use.
8. Read and follow instructions on compressed gas cylinders, associated equipment, and CGA publication P-1 listed in Safety Standards.

**WARNING**

Engines can be dangerous.

**WARNING**

ENGINE EXHAUST GASES can kill.

Engines produce harmful exhaust gases.

1. Use equipment outside in open, well-ventilated areas.

2. If used in a closed area, vent engine exhaust outside and away from any building air intakes.

**WARNING**

ENGINE FUEL can cause fire or explosion.

Engine fuel is highly flammable.

1. Stop engine before checking or adding fuel.
2. Do not add fuel while smoking or if unit is near any sparks or open flames.
3. Allow engine to cool before fueling. If possible, check and add fuel to cold engine before beginning job.
4. Do not overfill tank — allow room for fuel to expand.
5. Do not spill fuel. If fuel is spilled, clean up before starting engine.

**WARNING**

MOVING PARTS can cause injury.

Moving parts, such as fans, rotors, and belts can cut fingers and hands and catch loose clothing.

1. Keep all doors, panels, covers, and guards closed and securely in place.
2. Stop engine before installing or connecting unit.
3. Have only qualified people remove guards or covers for maintenance and troubleshooting as necessary.
4. To prevent accidental starting during servicing, disconnect negative (-) battery cable from battery.
5. Keep hands, hair, loose clothing, and tools away from moving parts.
6. Reinstall panels or guards and close doors when servicing is finished and before starting engine.

**WARNING**

SPARKS can cause BATTERY GASES TO EXPLODE; BATTERY ACID can burn eyes and skin.

Batteries contain acid and generate explosive gases.

1. Always wear a face shield when working on a battery.
2. Stop engine before disconnecting or connecting battery cables.
3. Do not allow tools to cause sparks when working on a battery.
4. Do not use welder to charge batteries or jump start vehicles.
5. Observe correct polarity (+ and -) on batteries.



WARNING

STEAM AND PRESSURIZED HOT COOLANT can burn face, eyes, and skin.

The coolant in the radiator can be very hot and under pressure.

1. Do not remove radiator cap when engine is hot. Allow engine to cool.
2. Wear gloves and put a rag over cap area when removing cap.
3. Allow pressure to escape before completely removing cap.



WARNING

This product, when used for welding or cutting, produces fumes or gases which contain chemicals known to the State of California to cause birth defects and, in some cases, cancer. (California Health & Safety code Sec. 25249.5 et seq.)

NOTE

Considerations About Welding And The Effects of Low Frequency Electric and Magnetic Fields

The following is a quotation from the General Conclusions Section of the U.S. Congress, Office of Technology Assessment, Biological Effects of Power Frequency Electric & Magnetic Fields - Background Paper, OTA-BP-E-63 (Washington, DC: U.S. Government Printing Office, May 1989): "...there is now a very large volume of scientific findings based on experiments at the cellular level and from studies with animals and people which clearly establish that low frequency magnetic fields interact with, and produce changes in, biological systems. While most of this work is of very high quality, the results are complex. Current scientific understanding does not yet allow us to interpret the evidence in a single coherent framework. Even more frustrating, it does not yet allow us to draw definite conclusions about questions of possible risk or to offer clear science-based advice on strategies to minimize or avoid potential risks."

To reduce magnetic fields in the workplace, use the following procedures:

1. Keep cables close together by twisting or taping them.
2. Arrange cables to one side and away from the operator.
3. Do not coil or drape cable around the body.
4. Keep welding power source and cables as far away from body as practical.

ABOUT PACEMAKERS:

The above procedures are among those also normally recommended for pacemaker wearers. Consult your doctor for complete information.

1.02 Principal Safety Standards

Safety in Welding and Cutting, ANSI Standard Z49.1, from American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33126.

Safety and Health Standards, OSHA 29 CFR 1910, from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Recommended Safe Practices for the Preparation for Welding and Cutting of Containers That Have Held Hazardous Substances, American Welding Society Standard AWS F4.1, from American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33126.

National Electrical Code, NFPA Standard 70, from National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

Safe Handling of Compressed Gases in Cylinders, CGA Pamphlet P-1, from Compressed Gas Association, 1235 Jefferson Davis Highway, Suite 501, Arlington, VA 22202.

Code for Safety in Welding and Cutting, CSA Standard W117.2, from Canadian Standards Association, Standards Sales, 178 Rexdale Boulevard, Rexdale, Ontario, Canada M9W 1R3.

Safe Practices for Occupation and Educational Eye and Face Protection, ANSI Standard Z87.1, from American National Standards Institute, 1430 Broadway, New York, NY 10018.

Cutting and Welding Processes, NFPA Standard 51B, from National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

1.03 Précautions de Sécurité en Soudage à l'Arc

**MISE EN GARDE**

LE SOUDAGE A L'ARC EST DANGEREUX

PROTEGEZ-VOUS, AINSI QUE LES AUTRES, CONTRE LES BLESSURES GRAVES POSSIBLES OU LA MORT. NE LAISSEZ PAS LES ENFANTS S'APPROCHER, NI LES PORTEURS DE STIMULATEUR CARDIAQUE (A MOINS QU'ILS N'AIENT CONSULTÉ UN MÉDECIN). CONSERVEZ CES INSTRUCTIONS. LISEZ LE MANUEL D'OPERATION OU LES INSTRUCTIONS AVANT D'INSTALLER, UTILISER OU ENTREtenir CET ÉQUIPEMENT.

Les produits et procédés de soudage peuvent causer des blessures graves ou la mort, de même que des dommages au reste du matériel et à la propriété, si l'utilisateur n'adhère pas strictement à toutes les règles de sécurité et ne prend pas les précautions nécessaires.

En soudage et coupage, des pratiques sécuritaires se sont développées suite à l'expérience passée. Ces pratiques doivent être apprises par étude ou entraînement avant d'utiliser l'équipement. Toute personne n'ayant pas suivi un entraînement intensif en soudage et coupage ne devrait pas tenter de souder. Certaines pratiques concernent les équipements raccordés aux lignes d'alimentation alors que d'autres s'adressent aux groupes électrogènes.

La norme Z49.1 de l'American National Standard, intitulée "SAFETY IN WELDING AND CUTTING" présente les pratiques sécuritaires à suivre. Ce document ainsi que d'autres guides que vous devriez connaître avant d'utiliser cet équipement sont présentés à la fin de ces instructions de sécurité.

SEULES DES PERSONNES QUALIFIÉES DOIVENT FAIRE DES TRAVAUX D'INSTALLATION, DE RÉPARATION, D'ENTRETIEN ET D'ESSAI.

1.04 Dangers Relatifs au Soudage à l'Arc

**AVERTISSEMENT**

L'ELECTROCUTION PEUT ÊTRE MORTELLE.

Une décharge électrique peut tuer ou brûler gravement. L'électrode et le circuit de soudage sont sous tension dès la mise en circuit. Le circuit d'alimentation et les circuits internes de l'équipement sont aussi sous tension dès la mise en marche. En soudage automatique ou semi-automatique avec fil, ce dernier, le rouleau ou la bobine de fil, le logement des galets d'entraînement et toutes les pièces métalliques en contact avec le fil de soudage sont sous tension. Un équipement inadéquatement installé ou inadéquatement mis à la terre est dangereux.

1. Ne touchez pas à des pièces sous tension.
2. Portez des gants et des vêtements isolants, secs et non troués.
3. Isolez-vous de la pièce à souder et de la mise à la terre au moyen de tapis isolants ou autres.
4. Déconnectez la prise d'alimentation de l'équipement ou arrêtez le moteur avant de l'installer ou d'en faire l'entretien. Bloquez le commutateur en circuit ouvert ou enlevez les fusibles de l'alimentation afin d'éviter une mise en marche accidentelle.
5. Veuillez à installer cet équipement et à le mettre à la terre selon le manuel d'utilisation et les codes nationaux, provinciaux et locaux applicables.

6. Arrêtez tout équipement après usage. Coupez l'alimentation de l'équipement s'il est hors d'usage ou inutilisé.
7. N'utilisez que des porte-électrodes bien isolés. Ne jamais plonger les porte-électrodes dans l'eau pour les refroidir. Ne jamais les laisser traîner par terre ou sur les pièces à souder. Ne touchez pas aux porte-électrodes raccordés à deux sources de courant en même temps. Ne jamais toucher quelqu'un d'autre avec l'électrode ou le porte-électrode.
8. N'utilisez pas de câbles électriques usés, endommagés, mal épissés ou de section trop petite.
9. N'enroulez pas de câbles électriques autour de votre corps.
10. N'utilisez qu'une bonne prise de masse pour la mise à la terre de la pièce à souder.
11. Ne touchez pas à l'électrode lorsqu'en contact avec le circuit de soudage (terre).
12. N'utilisez que des équipements en bon état. Réparez ou remplacez aussitôt les pièces endommagées.
13. Dans des espaces confinés ou mouillés, n'utilisez pas de source de courant alternatif, à moins qu'il soit muni d'un réducteur de tension. Utilisez plutôt une source de courant continu.
14. Portez un harnais de sécurité si vous travaillez en hauteur.
15. Fermez solidement tous les panneaux et les capots.



AVERTISSEMENT

LE RAYONNEMENT DE L'ARC PEUT BRÛLER LES YEUX ET LA PEAU; LE BRUIT PEUT ENDOMMAGER L'OUÏE.

L'arc de soudage produit une chaleur et des rayons ultraviolets intenses, susceptibles de brûler les yeux et la peau. Le bruit causé par certains procédés peut endommager l'ouïe.

1. Portez une casque de soudeur avec filtre oculaire de nuance appropriée (consultez la norme ANSI Z49 indiquée ci-après) pour vous protéger le visage et les yeux lorsque vous soudez ou que vous observez l'exécution d'une soudure.
2. Portez des lunettes de sécurité approuvées. Des écrans latéraux sont recommandés.
3. Entourez l'aire de soudage de rideaux ou de cloisons pour protéger les autres des coups d'arc ou de l'éblouissement; avertissez les observateurs de ne pas regarder l'arc.
4. Portez des vêtements en matériaux ignifuges et durables (laine et cuir) et des chaussures de sécurité.
5. Portez un casque antibruit ou des bouchons d'oreille approuvés lorsque le niveau de bruit est élevé.



AVERTISSEMENT

LES VAPEURS ET LES FUMÉES SONT DANGEREUSES POUR LA SANTÉ.

Le soudage dégage des vapeurs et des fumées dangereuses à respirer.

1. Eloignez la tête des fumées pour éviter de les respirer.
2. A l'intérieur, assurez-vous que l'aire de soudage est bien ventilée ou que les fumées et les vapeurs sont aspirées à l'arc.
3. Si la ventilation est inadéquate, portez un respirateur à adduction d'air approuvé.
4. Lisez les fiches signalétiques et les consignes du fabricant relatives aux métaux, aux produits consommables, aux revêtements et aux produits nettoyants.
5. Ne travaillez dans un espace confiné que s'il est bien ventilé; sinon, portez un respirateur à adduction d'air. Les gaz protecteurs de soudage peuvent déplacer l'oxygène de l'air et ainsi causer des malaises ou la mort. Assurez-vous que l'air est propre à la respiration.
6. Ne soudez pas à proximité d'opérations de dégraissage, de nettoyage ou de pulvérisation. La chaleur et les rayons de l'arc peuvent réagir avec des vapeurs et former des gaz hautement toxiques et irritants.

SELECTION DES NUANCES DE FILTRES OCULAIRES POUR LA PROTECTION
DES YEUX EN COUPAGE ET SOUDAGE (selon AWS à 8.2-73)

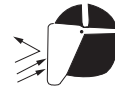
Opération de coupage ou soudage	Dimension d'électrode ou Epiasseur de métal ou Intensité de courant	Nuance de filtre oculaire	Opération de coupage ou soudage	Dimension d'électrode ou Epiasseur de métal ou Intensité de courant	Nuance de filtre oculaire
Brassage tendre au chalumeau	toutes conditions	2	Soudage à l'arc sous gaz avec fil plein (GMAW)		
Brassage fort au chalumeau	toutes conditions	3 ou 4	métaux non-ferreux	toutes conditions	11
Oxycoupage			métaux ferreux	toutes conditions	12
mince	moins de 1 po. (25 mm)	2 ou 3	Soudage à l'arc sous gaz avec électrode de tungstène (GTAW)	toutes conditions	12
moyen	de 1 à 6 po. (25 à 150 mm)	4 ou 5	Soudage à l'hydrogène atomique (AHW)	toutes conditions	12
épais	plus de 6 po. (150 mm)	5 ou 6	Soudage à l'arc avec électrode de carbone (CAW)	toutes conditions	12
Soudage aux gaz			Soudage à l'arc Plasma (PAW)	toutes dimensions	12
mince	moins de 1/8 po. (3 mm)	4 ou 5	Gougeage Air-Arc avec électrode de carbone		
moyen	de 1/8 à 1/2 po. (3 à 12 mm)	5 ou 6	mince		12
épais	plus de 1/2 po. (12 mm)	6 ou 8	épais		14
Soudage à l'arc avec électrode enrobées (SMAW)	moins de 5/32 po. (4 mm)	10	Coupage à l'arc Plasma (PAC)		
	5/32 à 1/4 po. (4 à 6.4 mm)	12	mince	moins de 300 amperès	9
	plus de 1/4 po. (6.4 mm)	14	moyen	de 300 à 400 amperès	12
			épais	plus de 400 amperès	14

7. Ne soudez des tôles galvanisées ou plaquées au plomb ou au cadmium que si les zones à souder ont été grattées à fond, que si l'espace est bien ventilé; si nécessaire portez un respirateur à ad-duction d'air. Car ces revêtements et tout métal qui contient ces éléments peuvent dégager des fumées toxiques au moment du soudage.

**AVERTISSEMENT****LE SOUDAGE PEUT CAUSER UN INCENDIE OU UNE EXPLOSION**

L'arc produit des étincelles et des projections. Les particules volantes, le métal chaud, les projections de soudure et l'équipement surchauffé peuvent causer un incendie et des brûlures. Le contact accidentel de l'électrode ou du fil-électrode avec un objet métallique peut provoquer des étincelles, un échauffement ou un incendie.

1. Protégez-vous, ainsi que les autres, contre les étincelles et du métal chaud.
2. Ne soudez pas dans un endroit où des particules volantes ou des projections peuvent atteindre des matériaux inflammables.
3. Enlevez toutes matières inflammables dans un rayon de 10, 7 mètres autour de l'arc, ou couvrez-les soigneusement avec des bâches approuvées.
4. Méfiez-vous des projections brûlantes de soudage susceptibles de pénétrer dans des aires adjacentes par de petites ouvertures ou fissures.
5. Méfiez-vous des incendies et gardez un extincteur à portée de la main.
6. N'oubliez pas qu'une soudure réalisée sur un plafond, un plancher, une cloison ou une paroi peut enflammer l'autre côté.
7. Ne soudez pas un récipient fermé, tel un réservoir ou un baril.
8. Connectez le câble de soudage le plus près possible de la zone de soudage pour empêcher le courant de suivre un long parcours inconnu, et prévenir ainsi les risques d'électrocution et d'incendie.
9. Ne dégelez pas les tuyaux avec un source de courant.
10. Otez l'électrode du porte-électrode ou coupez le fil au tube-contact lorsqu'inutilisé après le soudage.
11. Portez des vêtements protecteurs non huileux, tels des gants en cuir, une chemise épaisse, un pantalon revers, des bottines de sécurité et un casque.

**AVERTISSEMENT****LES ETINCELLES ET LES PROJECTIONS BRULANTES PEUVENT CAUSER DES BLESSURES.**

Le piquage et le meulage produisent des particules métalliques volantes. En refroidissant, la soudure peut projeter du éclats de laitier.

1. Portez un écran facial ou des lunettes protectrices approuvées. Des écrans latéraux sont recommandés.
2. Portez des vêtements appropriés pour protéger la peau.

**AVERTISSEMENT****LES BOUTEILLES ENDOMMAGEES PEUVENT EXPLOSER**

Les bouteilles contiennent des gaz protecteurs sous haute pression. Des bouteilles endommagées peuvent exploser. Comme les bouteilles font normalement partie du procédé de soudage, traitez-les avec soin.

1. Protégez les bouteilles de gaz comprimé contre les sources de chaleur intense, les chocs et les arcs de soudage.
2. Enchaînez verticalement les bouteilles à un support ou à un cadre fixe pour les empêcher de tomber ou d'être renversées.
3. Eloignez les bouteilles de tout circuit électrique ou de tout soudage.
4. Empêchez tout contact entre une bouteille et une électrode de soudage.
5. N'utilisez que des bouteilles de gaz protecteur, des détendeurs, des boyaux et des raccords conçus pour chaque application spécifique; ces équipements et les pièces connexes doivent être maintenus en bon état.
6. Ne placez pas le visage face à l'ouverture du robinet de la bouteille lors de son ouverture.
7. Laissez en place le chapeau de bouteille sauf si en utilisation ou lorsque raccordé pour utilisation.
8. Lisez et respectez les consignes relatives aux bouteilles de gaz comprimé et aux équipements connexes, ainsi que la publication P-1 de la CGA, identifiée dans la liste de documents ci-dessous.

**AVERTISSEMENT****LES MOTEURS PEUVENT ETRE DANGEREUX****LES GAZ D'ECHAPPEMENT DES MOTEURS PEUVENT ETRE MORTELS.**

Les moteurs produisent des gaz d'échappement nocifs.

POWERMASTER 500, 500P, 350, 350P

1. Utilisez l'équipement à l'extérieur dans des aires ouvertes et bien ventilées.
2. Si vous utilisez ces équipements dans un endroit confiné, les fumées d'échappement doivent être envoyées à l'extérieur, loin des prises d'air du bâtiment.



AVERTISSEMENT

LE CARBURANT PEUT CAUSER UN INCENDIE OU UNE EXPLOSION.

Le carburant est hautement inflammable.

1. Arrêtez le moteur avant de vérifier le niveau de carburant ou de faire le plein.
2. Ne faites pas le plein en fumant ou proche d'une source d'étincelles ou d'une flamme nue.
3. Si c'est possible, laissez le moteur refroidir avant de faire le plein de carburant ou d'en vérifier le niveau au début du soudage.
4. Ne faites pas le plein de carburant à ras bord: prévoyez de l'espace pour son expansion.
5. Faites attention de ne pas renverser de carburant. Nettoyez tout carburant renversé avant de faire démarrer le moteur.



AVERTISSEMENT

DES PIÈCES EN MOUVEMENT PEUVENT CAUSER DES BLESSURES.

Des pièces en mouvement, tels des ventilateurs, des rotors et des courroies peuvent couper doigts et mains, ou accrocher des vêtements amples.

1. Assurez-vous que les portes, les panneaux, les capots et les protecteurs soient bien fermés.
2. Avant d'installer ou de connecter un système, arrêtez le moteur.
3. Seules des personnes qualifiées doivent démonter des protecteurs ou des capots pour faire l'entretien ou le dépannage nécessaire.
4. Pour empêcher un démarrage accidentel pendant l'entretien, débranchez le câble d'accumulateur à la borne négative.
5. N'approchez pas les mains ou les cheveux de pièces en mouvement; elles peuvent aussi accrocher des vêtements amples et des outils.
6. Réinstallez les capots ou les protecteurs et fermez les portes après des travaux d'entretien et avant de faire démarrer le moteur.



AVERTISSEMENT

DES ÉTINCELLES PEUVENT FAIRE EXPLODER UN ACCUMULATEUR; L'ÉLECTROLYTE D'UN ACCUMULATEUR PEUT BRÛLER LA PEAU ET LES YEUX.

Les accumulateurs contiennent de l'électrolyte acide et dégagent des vapeurs explosives.

1. Portez toujours un écran facial en travaillant sur un accumulateur.
2. Arrêtez le moteur avant de connecter ou de déconnecter des câbles d'accumulateur.
3. N'utilisez que des outils anti-étincelles pour travailler sur un accumulateur.
4. N'utilisez pas une source de courant de soudage pour charger un accumulateur ou survolter momentanément un véhicule.
5. Utilisez la polarité correcte (+ et -) de l'accumulateur.



AVERTISSEMENT

LA VAPEUR ET LE LIQUIDE DE REFROIDISSEMENT BRÛLANT SOUS PRESSION PEUVENT BRÛLER LA PEAU ET LES YEUX.

Le liquide de refroidissement d'un radiateur peut être brûlant et sous pression.

1. N'ôtez pas le bouchon de radiateur tant que le moteur n'est pas refroidi.
2. Mettez des gants et posez un torchon sur le bouchon pour l'ôter.
3. Laissez la pression s'échapper avant d'ôter complètement le bouchon.

1.05 Principales Normes De Sécurité

Safety in Welding and Cutting, norme ANSI Z49.1, American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33128.

Safety and Health Standards, OSHA 29 CFR 1910, Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Recommended Safe Practices for the Preparation for Welding and Cutting of Containers That Have Held Hazardous Substances, norme AWS F4.1, American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33128.

National Electrical Code, norme 70 NFPA, National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

Safe Handling of Compressed Gases in Cylinders, document P-1, Compressed Gas Association, 1235 Jefferson Davis Highway, Suite 501, Arlington, VA 22202.

Code for Safety in Welding and Cutting, norme CSA W117.2 Association canadienne de normalisation, Standards Sales, 276 Rexdale Boulevard, Rexdale, Ontario, Canada M9W 1R3.

Safe Practices for Occupation and Educational Eye and Face Protection, norme ANSI Z87.1, American National Standards Institute, 1430 Broadway, New York, NY 10018.

Cutting and Welding Processes, norme 51B NFPA, National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

SECTION 2: INTRODUCTION

2.01 How To Use This Manual

This Owner's Manual applies to just specification or part numbers listed on page i.

To ensure safe operation, read the entire manual, including the chapter on safety instructions and warnings.

Throughout this manual, the words **WARNING**, **CAUTION**, and **NOTE** may appear. Pay particular attention to the information provided under these headings. These special annotations are easily recognized as follows:



WARNING

A WARNING gives information regarding possible personal injury.



CAUTION

A CAUTION refers to possible equipment damage.

NOTE

A NOTE offers helpful information concerning certain operating procedures.

Additional copies of this manual may be purchased by contacting Thermal Arc at the address and phone number in your area listed in the inside back cover of this manual. Include the Owner's Manual number and equipment identification numbers.

Electronic copies of this manual can also be downloaded at no charge in Acrobat PDF format by going to the Thermal Arc web site listed below and clicking on the Literature Library link:

<http://www.thermalarc.com>

2.02 Equipment Identification

The unit's identification number (specification or part number), model, and serial number usually appear on a nameplate attached to the rear panel. In some cases, the nameplate may be attached to the control panel. Equipment which does not have a name plate such as gun and cable assemblies is identified only by the specification or part number printed on the shipping container. Record these numbers on the bottom of page i for future reference.

2.03 Receipt Of Equipment

When you receive the equipment, check it against the invoice to make sure it is complete and inspect the equipment for possible damage due to shipping. If there is any damage, notify the carrier immediately to file a claim. Furnish complete information concerning damage claims or shipping errors to the location in your area listed in the inside back cover of this manual.

Include all equipment identification numbers as described above along with a full description of the parts in error.

Move the equipment to the installation site before uncrating the unit. Use care to avoid damaging the equipment when using bars, hammers, etc., to uncrate the unit.

2.04 Symbol Chart

Note that only some of these symbols will appear on your model.

	On
	Off
	Dangerous Voltage
	Increase/Decrease
	Circuit Breaker
	AC Auxiliary Power
	Fuse
A	Amperage
V	Voltage
Hz	Hertz (cycles/sec)
f	Frequency
—	Negative
+	Positive
	Direct Current (DC)
	Protective Earth (Ground)
	Line
	Line Connection
	Auxiliary Power
115V 15A 	Receptacle Rating-Auxiliary Power

1 	Single Phase
3 	Three Phase
	Three Phase Static Frequency Converter-Transformer-Rectifier
	Remote
X	Duty Cycle
%	Percentage
	Panel/Local
	Shielded Metal Arc Welding (SMAW)
	Gas Metal Arc Welding (GMAW)
	Gas Tungsten Arc Welding (GTAW)
	Air Carbon Arc Cutting (CAC-A)
	Constant Current
	Constant Voltage Or Constant Potential
	High Temperature
	Fault Indication
	Arc Force
	Touch Start (GTAW)
	Variable Inductance
	Voltage Input

	Wire Feed Function
	Wire Feed Towards Workpiece With Output Voltage Off.
	Welding Gun
	Purging Of Gas
	Continuous Weld Mode
	Spot Weld Mode
	Spot Time
	Prewflow Time
	Postflow Time
 2 Step Trigger Operation Press to initiate wirefeed and welding, release to stop.	
 4 Step Trigger Operation Press and hold for preflow, release to start arc. Press to stop arc, and hold for preflow.	
	Burnback Time
IPM	Inches Per Minute
MPM	Meters Per Minute
Art # A-04130	

2.05 General: Power-Master 500 & 350

The Power-Master 500 and 350 are primary inverter DC power sources that can be used for constant voltage and constant current weld processes. The Power-Master 500 output is rated at 450 Amps/38 Volts at 100% duty cycle and 560 Amps/42.4 Volts at 60% duty cycle. The Power-Master 350 output is rated at 300 Amps/32 Volts at 100% duty cycle and 350 Amps/34 Volts at 60% duty cycle. Both power source also provide 24VAC and 120VAC auxiliary outputs rated at 10 Amps.

Controls are built into the power source for Gas Tungsten arc welding (GTAW), Shielded Metal arc welding (SMAW), Carbon arc gouging (CAG) and Gas Metal arc welding (GMAW). An ArcForce/Inductance control is also provided to allow adjustment of the arc stiffness or drive for SMAW and GMAW welding processes

The graphs in Figure 2-1 show the output volt-amp characteristics of the Power-Master 500 power source.

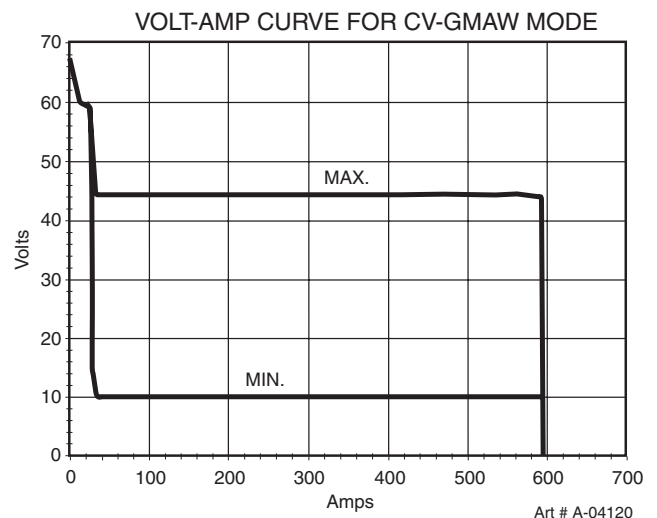
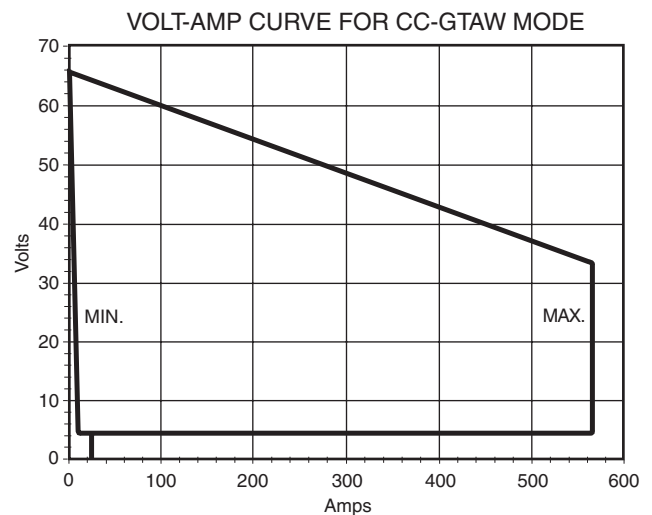
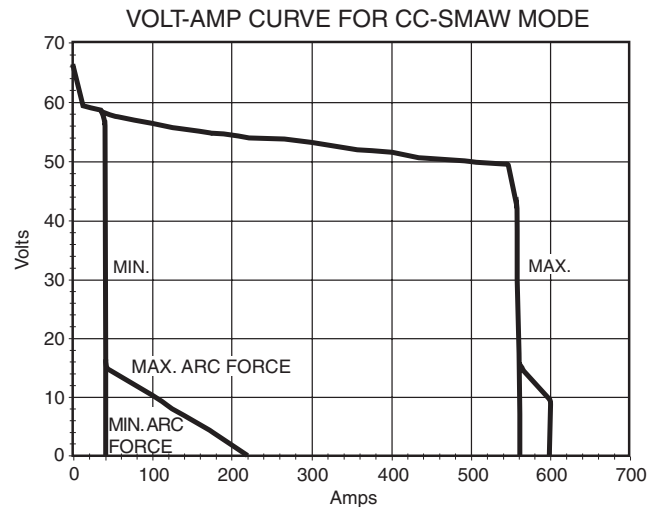


Figure 2-1 Power-Master 500 Power Source Volt-Amp Characteristics

2.06 Power-Master 500 Specifications

Input Data					
Line Voltage	Line Current	kVA	Eff.	PF	Output
208 VAC/3 Phase	68 Amps	24.5	89%	0.83	450A/38V/100% Duty Cycle
230 VAC/3 Phase	62 Amps	24.7	90%	0.82	450A/38V/100% Duty Cycle
380 VAC/3 Phase	40 Amps	23.7	89%	0.84	450A/38V/100% Duty Cycle
400 VAC/3 Phase	35 Amps	24.2	90%	0.84	450A/38V/100% Duty Cycle
460 VAC/3 Phase	30 Amps	23.9	91%	0.84	450A/38V/100% Duty Cycle
208 VAC/3 Phase	88 Amps	31.7	89%	0.88	500A/40.0V/60% Duty Cycle
230 VAC/3 Phase	82 Amps	32.7	89%	0.87	500A/40.0V/60% Duty Cycle
380 VAC/3 Phase	50 Amps	32.9	88%	0.87	480A/39.2V/60% Duty Cycle
400 VAC/3 Phase	43 Amps	29.8	91%	0.86	480A/39.2V/60% Duty Cycle
460 VAC/3 Phase	39 Amps	31.1	90%	0.88	500A/40.0V/60% Duty Cycle

Line Frequency:
Output Current Range:
Output Voltage Range:
Maximum Output Current:
Maximum Open Circuit Voltage (OCV):
Operating Temperature Range:
Input Line Variations:
Line Regulation:
Load Regulation:
Water Protection Class:

50/60 HZ
5 – 560 Amps
10 – 44 Volts
600 Amps
70 Volts (57 Volts for CCC)
0 – 40 C
± 10%
± 1%
± 1%
IP23S

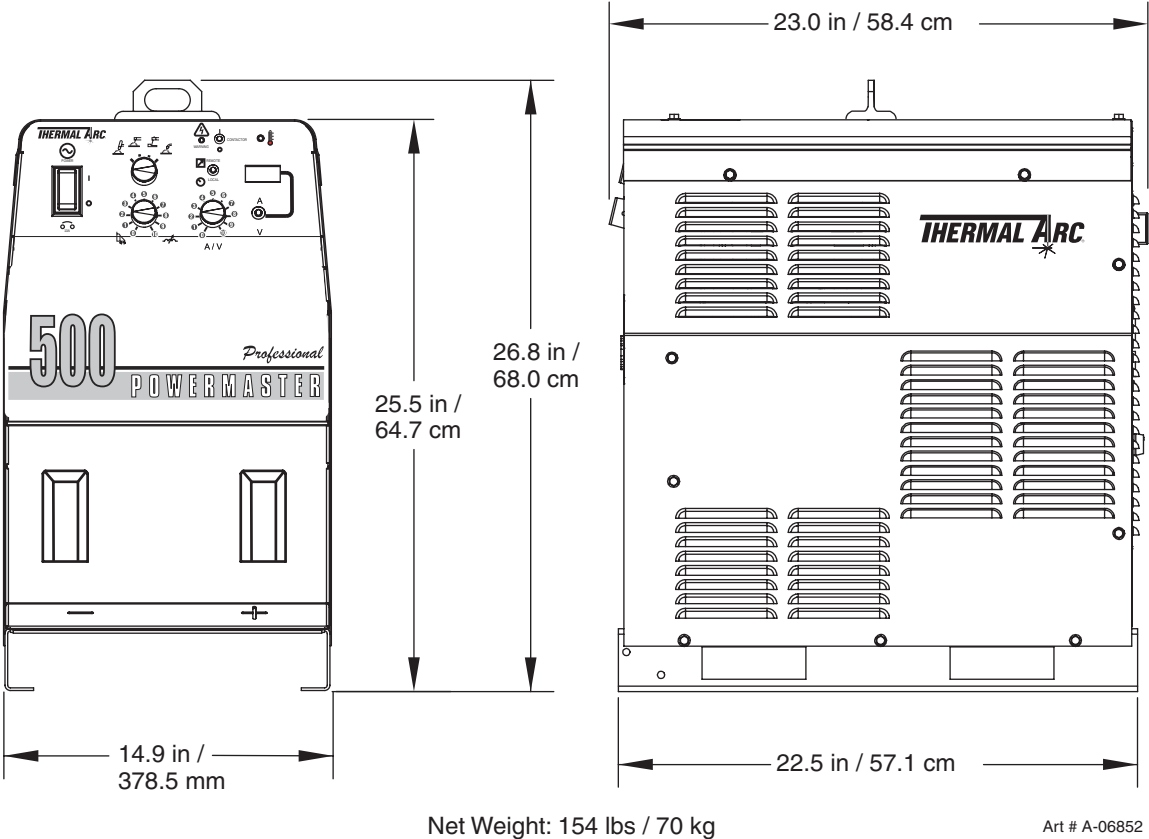
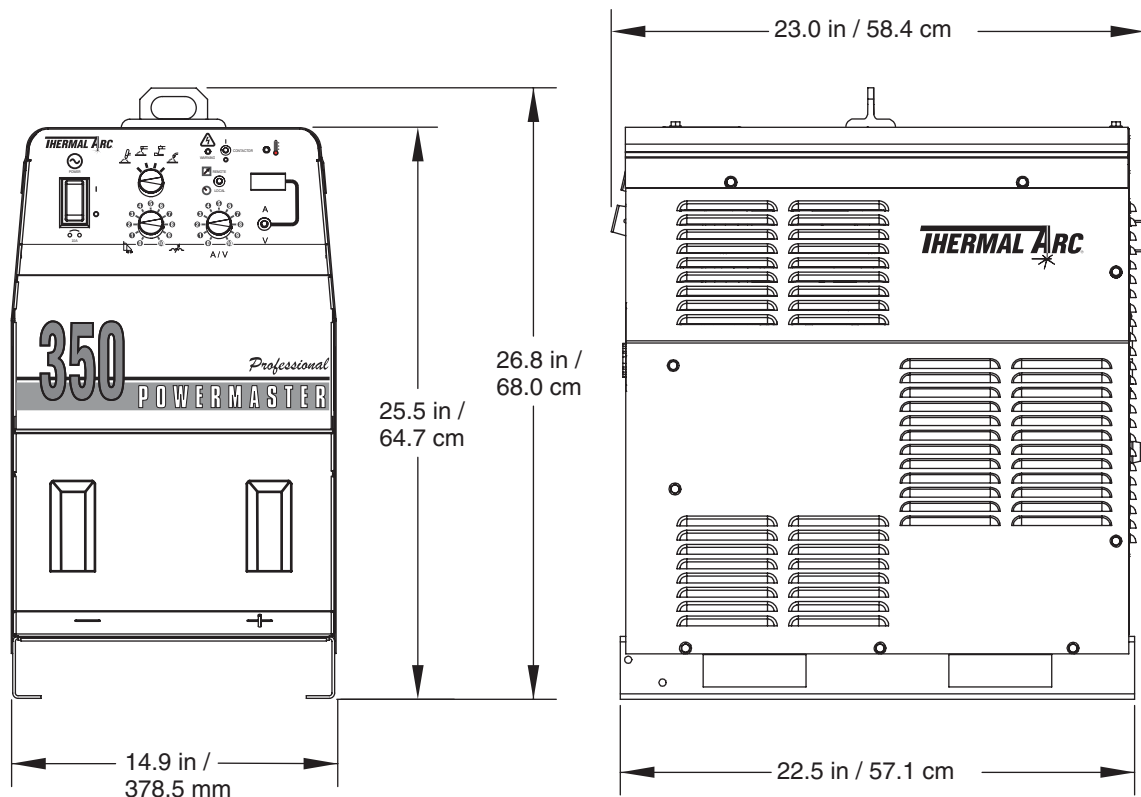


Figure 2-2: Power-Master 500 Dimensions

2.07 Power-Master 350 Specifications

Input Data					
Line Voltage	Line Current	kVA	Eff.	PF	Output
208 VAC/3 Phase	37 Amps	13.1	89%	0.83	300A/32V/100% Duty Cycle
230 VAC/3 Phase	33 Amps	13.1	89%	0.82	300A/32V/100% Duty Cycle
380 VAC/3 Phase	24 Amps	15.8	88%	0.82	300A/32V/100% Duty Cycle
400 VAC/3 Phase	19 Amps	13.1	89%	0.84	300A/32V/100% Duty Cycle
460 VAC/3 Phase	17 Amps	13.1	89%	0.84	300A/32V/100% Duty Cycle
208 VAC/3 Phase	43 Amps	15.4	89%	0.88	350A/34V/60% Duty Cycle
230 VAC/3 Phase	39 Amps	15.4	89%	0.87	350A/34V/60% Duty Cycle
380 VAC/3 Phase	28 Amps	18.4	88%	0.85	350A/34V/60% Duty Cycle
400 VAC/3 Phase	23 Amps	15.4	91%	0.86	350A/34V/60% Duty Cycle
460 VAC/3 Phase	20 Amps	15.4	90%	0.88	350A/34V/60% Duty Cycle

Line Frequency: 50/60 HZ
 Output Current Range: 5 – 560 Amps
 Output Voltage Range: 10 – 44 Volts
 Maximum Output Current: 600 Amps
 Maximum Open Circuit Voltage (OCV): 70 Volts (57 Volts for CCC)
 Operating Temperature Range: 0 – 40 C
 Input Line Variations: $\pm 10\%$
 Line Regulation: $\pm 1\%$
 Load Regulation: $\pm 1\%$
 Water Protection Class: IP23S



Net Weight: 154 lbs / 70 kg

Art # A-06853

Figure 2-3: Power-Master 350 Dimensions

POWERMASTER 500, 500P, 350, 350P

2.08 General: Power-Master 500P & 350P

The Power-Master 500 Pulse and 350 Pulse are primary inverter DC power sources that can be used for constant voltage and constant current weld processes. The Power-Master 500 Pulse output is rated at 450 Amps/38 Volts at 100% duty cycle and 560 Amps/42.4 Volts at 60% duty cycle. The Power-Master 350 Pulse output is rated at 300 Amps/32 Volts at 100% duty cycle and 350 Amps/34 Volts at 60% duty cycle. Both power source also provide 24VAC and 120VAC auxiliary outputs rated at 10 Amps.

Controls are built into the power source for Gas Tungsten arc welding (GTAW), Shielded Metal arc welding (SMAW), Gas Metal arc welding (GMAW), and Pulsed Gas Metal Arc Welding (P-GMAW). An Arc Force/Inductance control is also provided to allow adjustment of the arc characteristics for SMAW and GMAW welding processes

The graphs in Figure 2-4 show the output volt-amp characteristics of the power source for the SMAW, GTAW, and GMAW modes of operation.

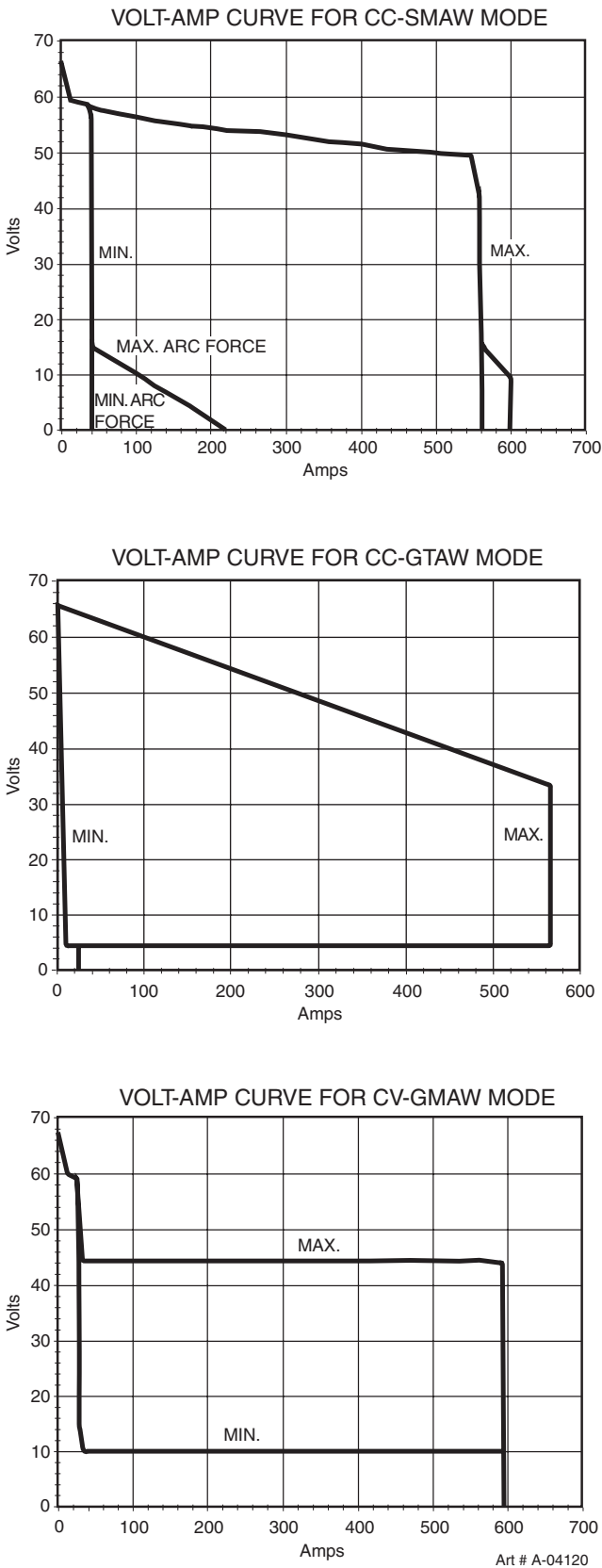
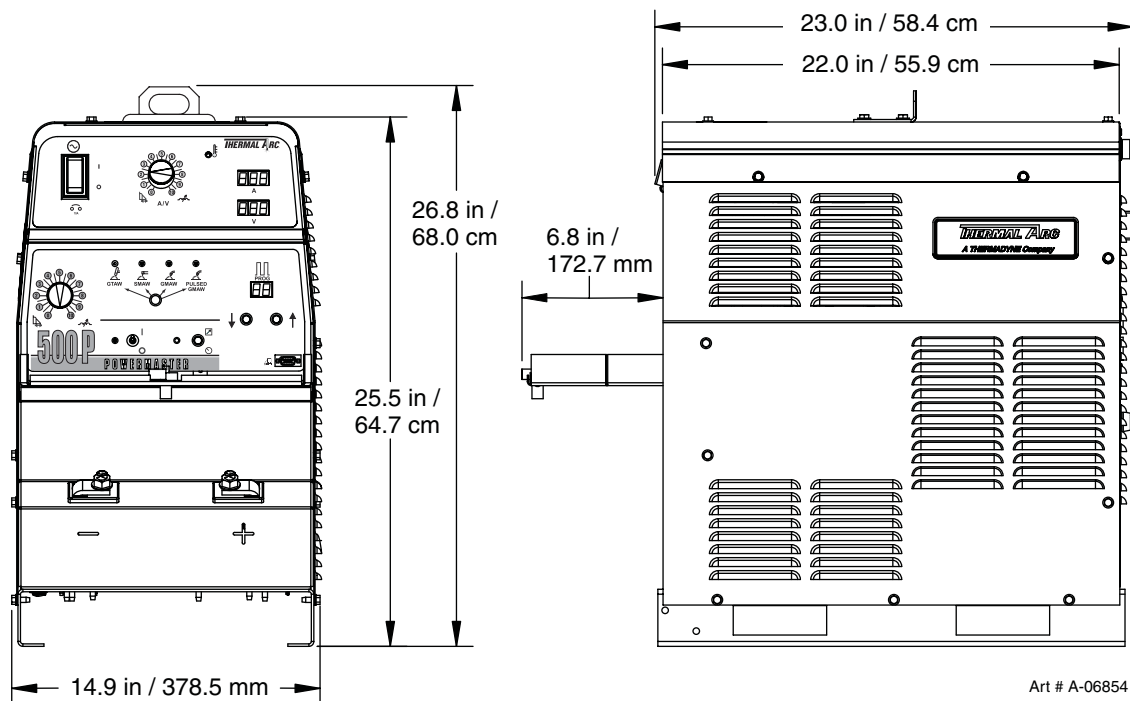


Figure 2-4 Power-Master 500P Power Source Volt-Amp Characteristics

2.09 Power-Master 500P Specifications

Input Data					
Line Voltage	Line Current	kVA	Eff.	PF	Output
208 VAC/3 Phase	68 Amps	24.5	89%	0.83	450A/38V/100% Duty Cycle
230 VAC/3 Phase	62 Amps	24.7	90%	0.82	450A/38V/100% Duty Cycle
380 VAC/3 Phase	40 Amps	23.7	89%	0.84	450A/38V/100% Duty Cycle
400 VAC/3 Phase	35 Amps	24.2	90%	0.84	450A/38V/100% Duty Cycle
460 VAC/3 Phase	30 Amps	23.9	91%	0.84	450A/38V/100% Duty Cycle
208 VAC/3 Phase	88 Amps	31.7	89%	0.88	500A/40.0V/60% Duty Cycle
230 VAC/3 Phase	82 Amps	32.7	89%	0.87	500A/40.0V/60% Duty Cycle
380 VAC/3 Phase	50 Amps	32.9	88%	0.87	480A/39.2V/60% Duty Cycle
400 VAC/3 Phase	43 Amps	29.8	91%	0.86	480A/39.2V/60% Duty Cycle
460 VAC/3 Phase	39 Amps	31.1	90%	0.88	500A/40.0V/60% Duty Cycle

Line Frequency: 50/60 HZ
 Output Current Range: 5 – 560 Amps
 Output Voltage Range: 10 – 44 Volts
 Maximum Output Current: 600 Amps
 Maximum Open Circuit Voltage (OCV): 70 Volts (57 Volts for CCC)
 Operating Temperature Range: 0 – 40 C
 Input Line Variations: $\pm 10\%$
 Line Regulation: $\pm 1\%$
 Load Regulation: $\pm 1\%$
 Water Protection Class: IP23S



Art # A-06854

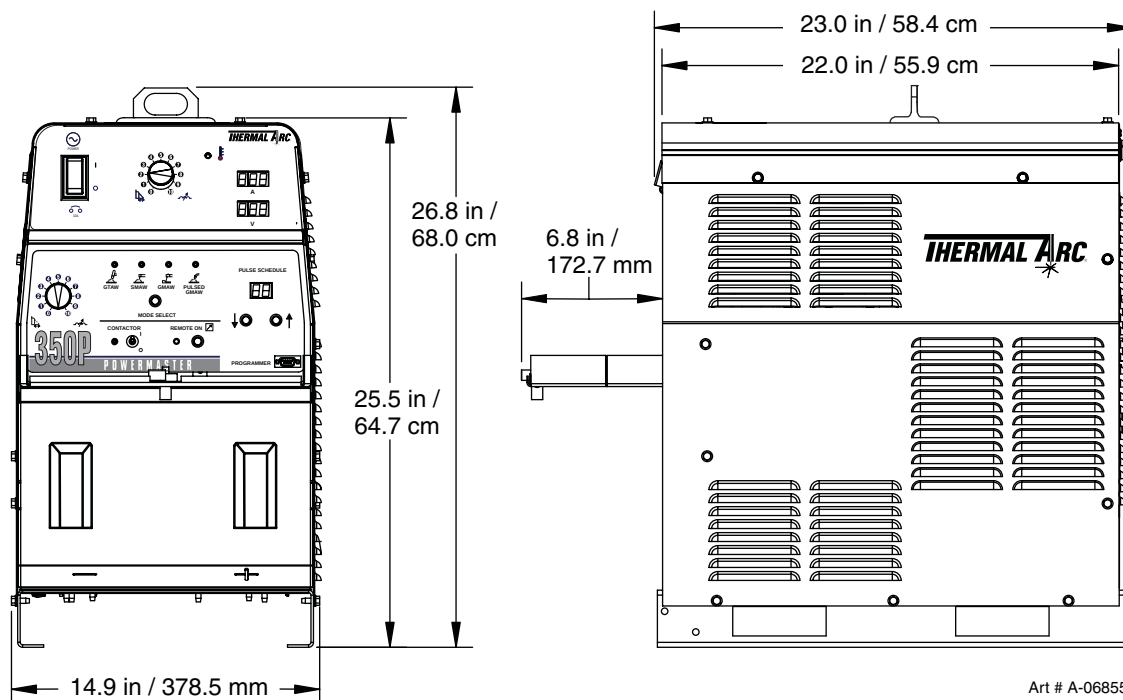
Net Weight: 154 lbs / 70 kg

Figure 2-5: Power-Master 500P Dimensions

2.10 Power-Master 350P Specifications

Input Data					
Line Voltage	Line Current	kVA	Eff.	PF	Output
208 VAC/3 Phase	37 Amps	13.1	89%	0.83	300A/32V/100% Duty Cycle
230 VAC/3 Phase	33 Amps	13.1	89%	0.82	300A/32V/100% Duty Cycle
380 VAC/3 Phase	24 Amps	15.8	88%	0.82	300A/32V/100% Duty Cycle
400 VAC/3 Phase	19 Amps	13.1	89%	0.84	300A/32V/100% Duty Cycle
460 VAC/3 Phase	17 Amps	13.1	89%	0.84	300A/32V/100% Duty Cycle
208 VAC/3 Phase	43 Amps	15.4	89%	0.88	350A/34V/60% Duty Cycle
230 VAC/3 Phase	39 Amps	15.4	89%	0.87	350A/34V/60% Duty Cycle
380 VAC/3 Phase	28 Amps	18.4	88%	0.85	350A/34V/60% Duty Cycle
400 VAC/3 Phase	23 Amps	15.4	91%	0.86	350A/34V/60% Duty Cycle
460 VAC/3 Phase	20 Amps	15.4	90%	0.88	350A/34V/60% Duty Cycle

Line Frequency: 50/60 HZ
 Output Current Range: 5 – 560 Amps
 Output Voltage Range: 10 – 44 Volts
 Maximum Output Current: 600 Amps
 Maximum Open Circuit Voltage (OCV): 70 Volts (57 Volts for CCC)
 Operating Temperature Range: 0 – 40 C
 Input Line Variations: $\pm 10\%$
 Line Regulation: $\pm 1\%$
 Load Regulation: $\pm 1\%$
 Water Protection Class: IP23S



Net Weight: 154 lbs / 70 kg

Figure 2-6: Power-Master 350P Dimensions

2.11 Standard Features

- 1. Short-Circuit Protection** – The output of the power source can be short circuited in any of the modes of operation. This protection feature will instantly limit the output current to a safe value, to assure reliable operation of the power source.
- 2. Output Overload Protection** – The overload protection feature will limit the continuous weld current to the maximum value listed in the specifications for any of the modes of operation. The machine will continue to operate but the current will be limited to this maximum value.
- 3. Cooling Fan Control** – The cooling fans are designed to operate only when required. They will come on whenever the output contactor control of the machine is on. The fans will come on for several minutes when the machine is first turned on and will normally stay on for several minutes after the output contactor control has been switched off. The fans will turn off after several minutes of inactivity, to minimize the amount of dirt being drawn into the machine, as well as lengthen the life of the fans.
- 4. Overtemperature Protection** – If the machine overheats because of blocked air flow, excessive ambient temperatures, failed fan, or other cause, the overtemperature protection will disable the output of the power source until it has cooled down. If the overtemperature protection circuit operates, it will turn on the indicator light on the front panel and the fans should continue to run until the machine cools. The overtemperature circuit will reset itself automatically once the machine has cooled.
- 5. Multi-Voltage Operation** – The power source is designed to operate from a wide range of input line voltages as given in the specifications. The machine can be reconfigured for the different line voltages with a simple, rugged voltage changeover panel (refer to Installation chapter for detailed instructions).
- 6. Multi-Process Operation** – The machine has built in electronic controls which have been optimized for most welding processes. The following controls are standard: GTAW with Lift Start, SMAW, CAG, GMAW/FCAW including the short-arc, globular and spray transfer modes. Each mode of operation has a dedicated electronic control which has been optimized for that particular process.

2.12 500P/350P Programmable Features

- 1. Lockout features:** Any or all of the following controls can be locked out on the Power-Master 500P/350P so they will have no affect on the operation of the machine. The machine will remain in whatever mode or condition it is in before the feature is locked out.
 - 1.1 Mode Select Switch - Prevents changing of the mode of operation.
 - 1.2 Remote On Switch - Prevents changing of the remote control feature.
 - 1.3 Schedule Select Switches - Prevents changing of the pulse mig schedule.
- 2. Restricted output adjustment:** The range of adjustment of the output of the power source can be restricted for the various modes of operation.
 - 2.1 Amps Adjust Range Locked: A high and low amperage limit can be programmed which will limit the output amperage adjust range. This amperage adjust range is in effect for both GTAW and SMAW modes.
 - 2.2 Volts Adjust Range Locked: A high and low voltage limit can be programmed for GMAW modes which will limit the voltage adjust range of the power source.
 - 2.3 Pulse Reference Range Locked: A high and low pulse reference limit can be programmed which will limit the adjust range of the output of the machine for the Pulsed-GMAW mode.
- 3. Pulse Parameters:** All 24 of the Pulsed GMAW schedules can be modified, to allow for a very flexible design of the optimum pulse waveform. In addition the arc starting conditions, and arc end conditions can be modified.
- 4. Wire sharp:** Both GMAW and Pulsed GMAW modes provide a wire sharpening sequence at the end of the weld to condition the end of the wire. The wire sharpening time and voltage can be modified.
- 5. Meter Functions:** The meter hold feature and meter refresh rate can both be modified if desired.
- 6. Software Control:** In addition to the programmable features of the Power-Master 500P, the power source can be controlled through either the programmer port or the CAN port. This includes complete control of the power source, such as mode, pulse schedule, pulse parameters, remote/local control, etc. Most of the features of the power source can be controlled in real time under live arc conditions.

SECTION 3: INSTALLATION

3.01 Location

Adequate air circulation is needed at all times in order to assure proper operation. Provide a minimum of 12 inches (305 mm) of free airspace on all sides of the unit. Make sure that the ventilator openings are not obstructed. Ventilation air flow is from rear to side.

3.02 Voltage Changeover

For proper operation and to prevent damage to the machine, the voltage changeover must be set according to the incoming AC line voltage. Remove the left side panel of the machine to gain access to the voltage changeover board. Set the links to agree with one of the four available voltage settings. (See Figures 3-1 through 3-4).

The four settings are:

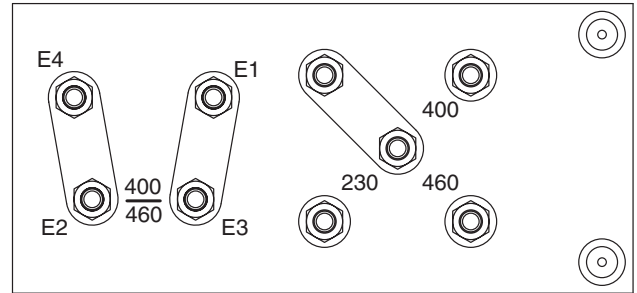
200 VAC	230 VAC
400VAC and 380VAC	460 VAC

1. Check the name plate of the machine for proper line voltage.
2. Move the voltage links by loosening the nuts securing the links in place. For 200 and 230 VAC settings place the two links in the 200/230V positions. For 380, 400 and 460 VAC settings place the two links directly on top of each other in the 400/460V position. See figures 3-1 through 3-4. Make sure that the connections are properly tightened.



ELECTRIC SHOCK CAN KILL.

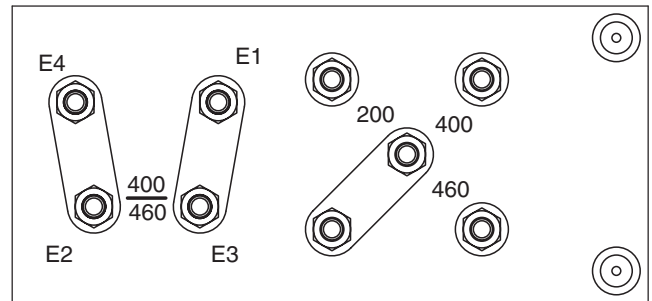
Open the main wall disconnect switch or breaker, before removing any covers or access panels on the welding machine. Live voltage is still present even with the front panel control switch OFF. Wait at least three full minutes after power has been removed before removing any covers or access panels to allow adequate time for internal capacitors to discharge.



200 VOLT CONNECTION

Art # A-04083

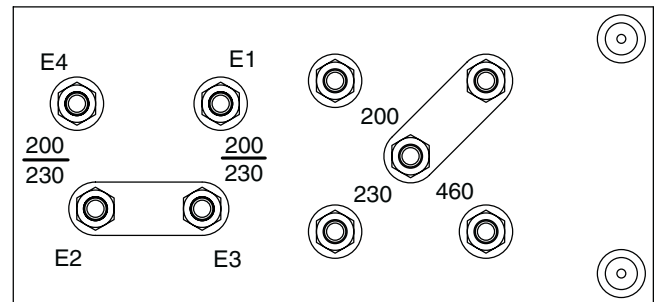
Figure 3-1



230 VOLT CONNECTION

Art # A-04084

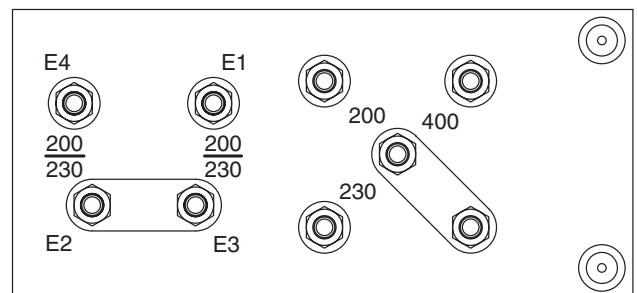
Figure 3-2



380 / 400 VOLT CONNECTION

Art # A-04085

Figure 3-3



460 VOLT CONNECTION

Art # A-04086

Figure 3-4

3.03 Connecting Welding Machine to Line Voltage

The input power should be connected to the unit through a fused disconnect switch, or other suitable disconnecting means furnished by the user. Access is provided in the rear panel of the machine for the entry of the input conductors.



DANGER:

ELECTRIC SHOCK CAN KILL.

Open the disconnect switch, or breaker, and determine that no voltage is present, before connecting wires between welding machine and power supply.



CAUTION:

The method of installation, conductor size, and overcurrent protection shall conform to the requirements of the local electrical code, the National Electrical Code, or other national codes, as applicable. All installation wiring and machine reconnection shall be done by qualified persons.

Table 3-1 provides minimal information for selection of line conductors, fuses, and the equipment grounding conductor. This information is from the National Electrical Code NFPA 70-1981 Edition. Install this equipment per the latest edition, available from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

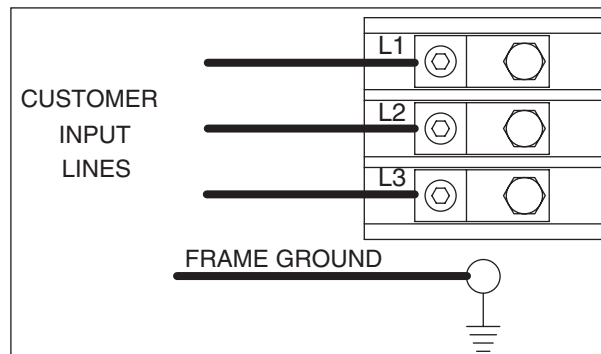
Line Volts	Rated Line Amps	Approx. Line Fuse Size Amps	Copper Line Wire Size*	Copper Grounding Conductor Min. Size
200	88	100	No. 6 (16 mm ²)	No. 6 (16 mm ²)
230	82	100	No. 6 (16 mm ²)	No. 6 (16 mm ²)
380	50	60	No. 6 (16 mm ²)	No. 6 (16 mm ²)
400	43	60	No. 10 (6 mm ²)	No. 10 (6 mm ²)
460	39	60	No. 10 (6 mm ²)	No. 10 (6 mm ²)

Table 3-1 Recommended Wire and Fuse Size Table

*Conductor size shall be modified as required for line voltage and ambient temperature. Sizes listed are based on 90° conductor insulation, designated as FEP, FEPB, RHH, and THHN.

3.04 Connection Instructions

1. Remove left side panel to gain access to the input terminal block and ground screw.
2. Connect the three phase power line to the terminal block as shown in Figure 3-5.
3. Connect the power system safety ground to the screw labeled FRAME GROUND located on the base of the machine near the input terminal block as shown in Figure 3-5.
4. Replace side panel.



Art # A-04100

Figure 3-5 Input Terminal Block



WARNING:

Never connect the safety ground screw to one of the three line phases. This would represent a serious electrical shock hazard. The wiring to this machine should be performed by a qualified person only.

3.05 Grounding

The frame of this welding machine should be grounded for personnel safety, and to assure operation of the overcurrent protection. The grounding method, and the equipment grounding conductor size and type shall conform to local and national codes.

For the National Electrical Code, the equipment grounding conductor shall be green, green with a yellow stripe, or bare.

If flexible power cable is used, use a cable assembly which includes the equipment grounding conductor. If metallic armored cable or conduit is used, the metal sheathing or conduit must be effectively grounded per local and national codes.

Rubber-tire mounted equipment shall be grounded to conform to local and national codes. The grounding assists in providing protection against line voltage electrical shock and static shock. The grounding serves to discharge the static electric charge which tends to build up on rubber-tire mounted equipment. This static charge can cause painful shock and lead to the erroneous conclusion that an electrical fault exists in the equipment.

If a system ground is not available, consult the electrical code enforcement body for instructions. The welding machine should be connected to an adequate driven ground rod, or to a water pipe that enters the ground not more than 10 feet (3 meters) from the machine.

The equipment grounding conductor size is listed in Table 3-1 as a guide if no local or national code is applicable. Attach the equipment grounding conductor to the stud provided on the yoke panel. Determine that the ground wire size is adequate before the machine is operated.

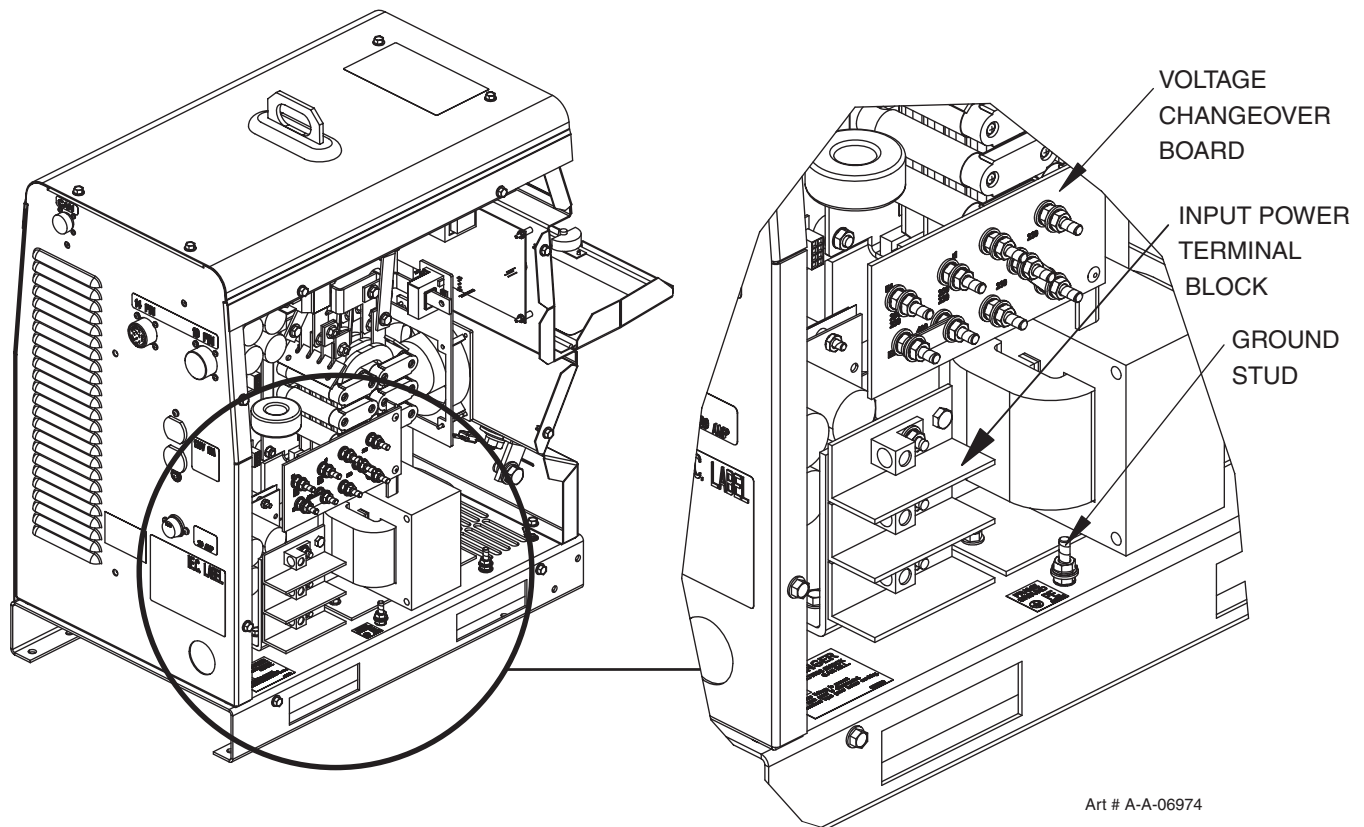


Figure 3-6: Ground Stud Location

3.06 Welding Leads

Connect the welding leads to the output bus bar terminals of the power source. Selection of the proper size of welding leads should be based upon both the rated ampacity of the wire as well as the voltage drop on the cable. When considering voltage drop, the entire loop (electrode plus work lead) must be considered.

Refer to Table 3-2 as a basic guideline to the required copper cable sizes.

As a general rule, the welding cables should be kept as short as possible and placed close together. Try to avoid coiling up the cables if possible. A damaged or frayed cable should not be used, and all connections must be properly tightened.

Avg. Welding Amps	TOTAL LENGTH OF LEAD CIRCUIT IN FEET AND METERS (ELECTRODE LEAD PLUS WORK LEAD)				
	50 Feet (15.2 m)	100 Feet (30.5 m)	150 Feet (45.7 m)	200 Feet (61.0 m)	250 Feet (76.2 m)
100	#4 (20 mm ²)	#4 (20 mm ²)	#2 (35 mm ²)	#1 (50 mm ²)	#1 (50 mm ²)
150	#3 (25 mm ²)	#3 (25 mm ²)	#1 (50 mm ²)	#1/0 (50 mm ²)	#2/0 (70 mm ²)
200	#2 (35 mm ²)	#2 (35mm2)	#1/0 (50 mm ²)	#2/0 (70 mm ²)	#3/0 (95 mm ²)
250	#1 (50 mm ²)	#1 (50 mm ²)	#2/0 (70 mm ²)	#3/0 (95 mm ²)	#4/0 (120 mm ²)
300	#1/0 (50 mm ²)	#1/0 (50 mm ²)	#3/0 (95 mm ²)	#4/0 (120 mm ²)	2 - #2/0 2 - (70 mm ²)
350	#2/0 (70 mm ²)	#2/0 (70 mm ²)	#4/0 (120 mm ²)	2 - #2/0 2 - (70 mm ²)	2 - #2/0 2 - (70 mm ²)
400	#3/0 (95 mm ²)	#3/0 (95 mm ²)	#4/0 (120 mm ²)	2 - #2/0 2 - (70 mm ²)	2 - #3/0 2 - (95 mm ²)
450	#3/0 (95 mm ²)	#3/0 (95 mm ²)	#4/0 (120 mm ²)	2 - #3/0 2 - (95 mm ²)	2 - #3/0 2 - (95 mm ²)
500	#4/0 (120 mm ²)	#4/0 (120 mm ²)	2 - #2/0 2 - (70 mm ²)	2 - #3/0 2 - (95 mm ²)	2 - #4/0 2 - (120 mm ²)
550	#4/0 (120 mm ²)	#4/0 (120 mm ²)	2 - #2/0 2 - (70 mm ²)	2 - #4/0 2 - (120 mm ²)	2 - #4/0 2 - (120 mm ²)
600	#4/0 (120 mm ²)	#4/0 (120 mm ²)	2 - #3/0 2 - (95 mm ²)	2 - #4/0 2 - (120 mm ²)	2 - #4/0 2 - (120 mm ²)

NOTE: Lead size shown is for 194°F (90°C) cable insulation, 86°F (30°C) ambient, and not over 4.5 volts lead drop.

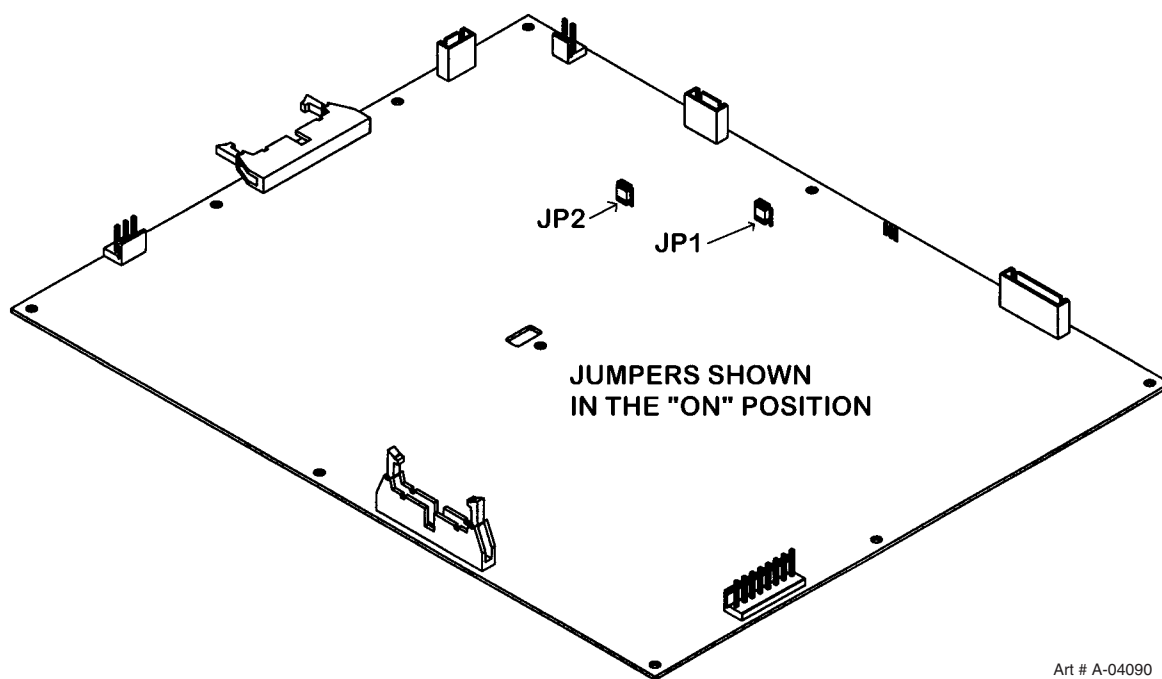
Table 3-2: Lead Circuit Lengths by Welding Amps

3.07 Configuration Settings

A. Lift-Arc GTAW

The power source is configured from the factory with the Lift-Arc starting circuit active for GTAW. This feature should be disabled if an external high voltage arc starter is being used to start the arc. To disable the lift arc feature proceed as follows:

1. Turn off the power to the power source at the main disconnect.
2. Remove the top panel to gain access to the main control board (see Figure 3-7).
3. To disable Lift-Arc place jumper plugs JP1 and JP2 in the OFF position (pins 2 to 3 shorted).
4. To re-enable Lift-Arc place jumper plugs JP1 and JP2 back in the ON position (1 to 2 shorted).
5. Replace the top panel.



Art # A-04090

Figure 3-7 Main Control Board

POWERMASTER 500, 500P, 350, 350P

B. Wire-Sharpening for GMAW (Power-Master 500P and 350P Only)

The power source is configured from the factory with the Wire-Sharpening circuit active for GMAW. This feature improves arc starting by reducing the size of the ball on the wire at the end of the weld. To disable this feature proceed as follows:

1. Turn off the power to the power source at the main disconnect.
2. Remove the top and side panels to gain access to the display board. (see Figure 3-8).
3. Remove the knobs and hardware from the front panel to allow removal of the display board.
4. To disable Wire-Sharpening place jumper plug JP1 in the OFF position (pins 3 to 4 shorted).
5. To re-enable Wire-Sharpening place jumper plug JP1 back in the ON position (pins 1 to 2 shorted).
6. Replace board and panels.

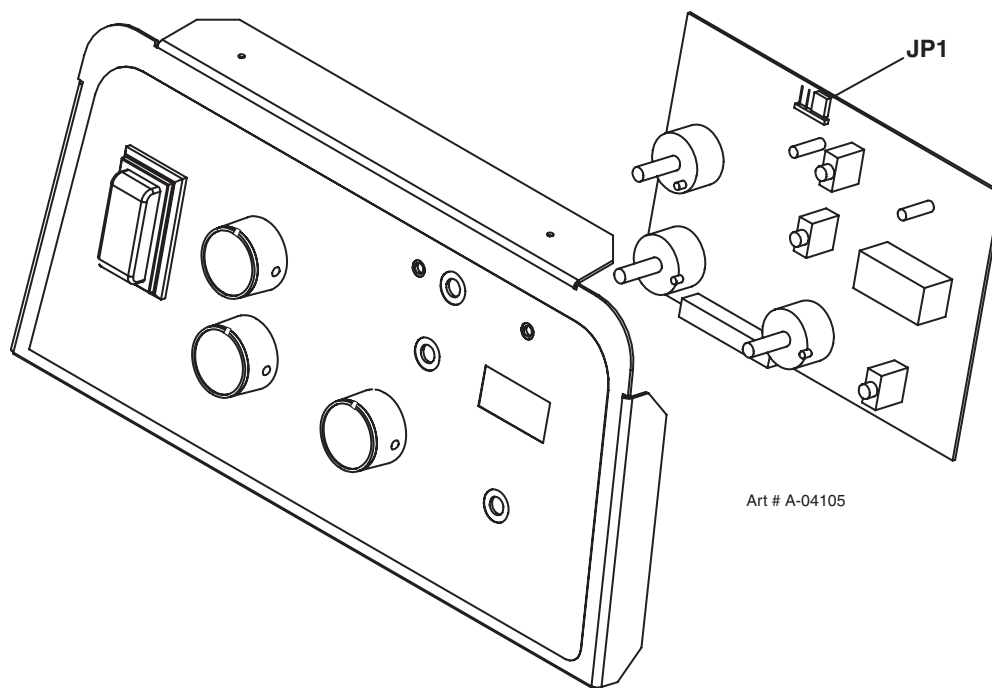


Figure 3-8 Wire-Sharpening jumper plug

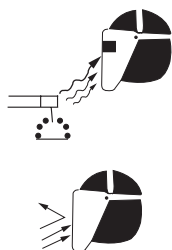
SECTION 4: OPERATION

4.01 General Safety Precautions

Read and understand the safety instructions at the beginning of this manual prior to operating this machine.



Be sure to put on proper protective clothing and eye safeguards (welding coat, apron, gloves, and welding helmet, with proper lenses installed). See Safety Instructions and Warnings chapter included in this manual. Neglect of these precautions may result in personal injury.



Make all connections to the power source including electrode and work cables, as well as remote control cables, with the power source turned off. These connections could be electrically live with the power switch ON.



POWERMASTER 500, 500P, 350, 350P

4.02 Power-Master 500 and 350 Controls

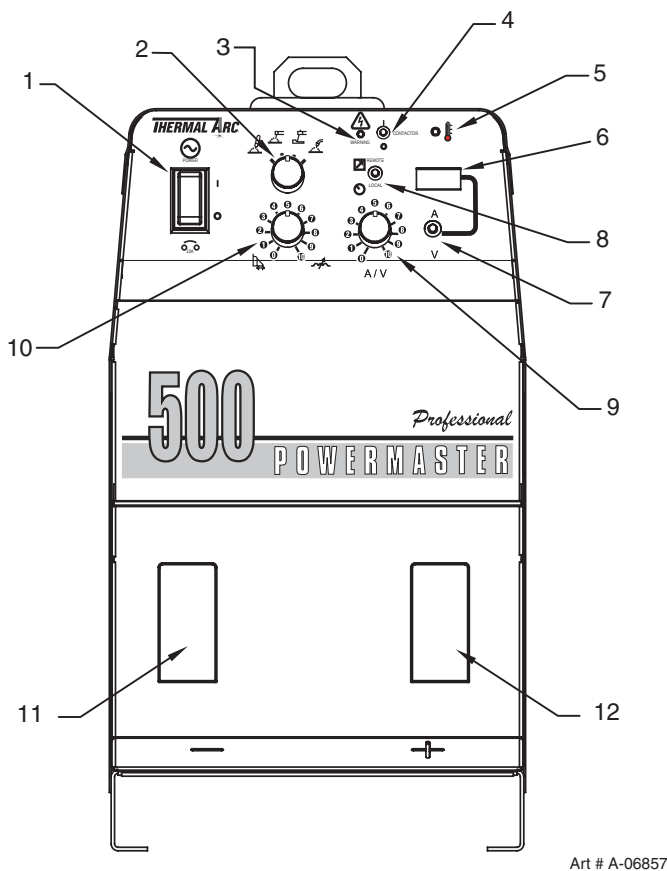


Figure 4-1: Power-Master 500 and 350 Front Panel

1. Control Power ON/OFF Switch: This circuit breaker/switch activates the controls on the power source. When this switch is in the OFF position, the power source is in standby mode. There is still line voltage present internal to the machine, but the controls are not energized. In the ON position the control power is applied and the controls are energized. In the ON position the digital display should be on. This circuit breaker/switch also protects the auxiliary 24 VAC and 115 VAC power in the case of an overload. If circuit breaker trips, determine cause of overload before resetting. Allow breaker time to cool before resetting.

2. Mode Select Switch: The mode select switch is a four-position switch used to select the weld process. The four modes are as follows:

GTAW mode: In this mode the power source operates in constant current mode with a lift arc starting circuit activated and arc force/inductance disabled. The lift arc circuit allows the arc to be initiated by momentarily touching the tungsten to the work and then lifting. The lift arc circuit limits the “touch” current to a low value and then switches to preset current after lifting. The lift arc feature can be disabled if desired to allow “scratch” starting by moving two jumpers internal to the machine on the main control board. (See configuration settings under Installation instructions chapter of this manual for an explanation of how to disable the lift arc feature)

SMAW mode: In this mode the power source operates in constant current mode with the arc force control enabled.

CAG mode: In this mode the power source operates in constant current mode with arc force/inductance control disabled.

GMAW mode: In this mode the power source operates in constant voltage mode with the inductance control enabled. A Wire-Sharpening circuit is also active to help condition the end of the wire when the weld is complete to improve the arc start on the next weld. The Wire-Sharpening feature can be disabled if desired. (See configuration settings under Installation instructions chapter of this manual for an explanation of how to disable the Wire-Sharpening feature).

3. Output Contactor Indicator: This green light will be ON whenever the output of the welding machine is energized.

4. Output Contactor Switch: This switch is used to energize the output of the machine.

5. Overtemp Indicator: This amber light will be ON whenever an overtemperature condition has been detected internal to the machine. This light will remain on with the fans running until the unit cools down. If this light is on, the output of the machine will be disabled. Once the machine cools down this light will go off and the overtemperature condition will automatically reset.

- 6. Meter Display:** The digital meter is used to preset the output voltage or current when the power source is not welding, and to display the actual amps or volts while welding. To preset output current (amps) for GTAW, SMAW or CAG, place meter Amps/Volts switch in the Amps position and adjust the main Amps/Volts control potentiometer to the desired current. To preset output volts for GMAW, place the meter Amps/Volts switch in the Volts position and adjust the main Amps/Volts control potentiometer to the desired voltage. The meter will automatically switch over to actual amps or volts while welding, depending on the position of the meter Amps/Volts switch.
- 7. Meter Amps/Volts Switch:** This two-position toggle switch is used to select whether the digital meter will display amps or volts. To preset weld amperage for GTAW, SMAW or CAG, place this switch in the AMPS position. To preset weld voltage for GMAW, place this switch in the VOLTS mode. After an arc has been initiated, this switch allows either actual weld amps or weld volts to be displayed on the meter.
- 8. Remote/Local Switch:** The remote/local toggle switch is used to select either front panel control of output amps/volts (LOCAL mode), or remote control of output amps/volts through the 19 pin or 14 pin receptacles located on the rear panel (REMOTE mode). For GTAW mode, the maximum output current must be preset by the front panel Amps/Volts control pot. For all other modes, the remote control is full output of the machine.
- 9. Amps/Volts Control:** This control potentiometer sets the output amps or volts depending on the weld process. Clockwise is increasing output. For all modes except GTAW, this control is only active when the LOCAL/REMOTE switch is in the LOCAL mode. For GTAW this control potentiometer is used to set the maximum weld current available to a foot pedal or hand control. To preset maximum output for GTAW, place the LOCAL/REMOTE switch in the LOCAL mode and set the maximum desired amperage on the digital meter. (The meter amps/volts switch must be in the amps position). Place the LOCAL/REMOTE switch in the REMOTE mode to activate foot pedal control.
- 10. Arc Force/Inductance Control:** This control pot. is active for SMAW (Stick) and GMAW (MIG). In SMAW mode, this potentiometer controls the amount of arc force or dig that the arc has. Maximum arc force is full clockwise, full counter-clockwise is zero arc force. In GMAW mode, this becomes an inductance control. Maximum inductance is full clockwise. Higher inductance settings make the arc “softer” with less spatter. Lower inductance settings give a stronger “driving” arc. The inductance should be set according to the type of wire and gas and desired arc characteristics desired. Generally, the inductance control can be set at mid-range as a good starting point.
- 11. Output Negative Terminal:** Connection point for negative welding lead.
- 12. Output Positive Terminal:** Connection point for positive welding lead.

POWERMATER 500, 500P, 350, 350P

4.03 Power-Master 500P and 350P Controls

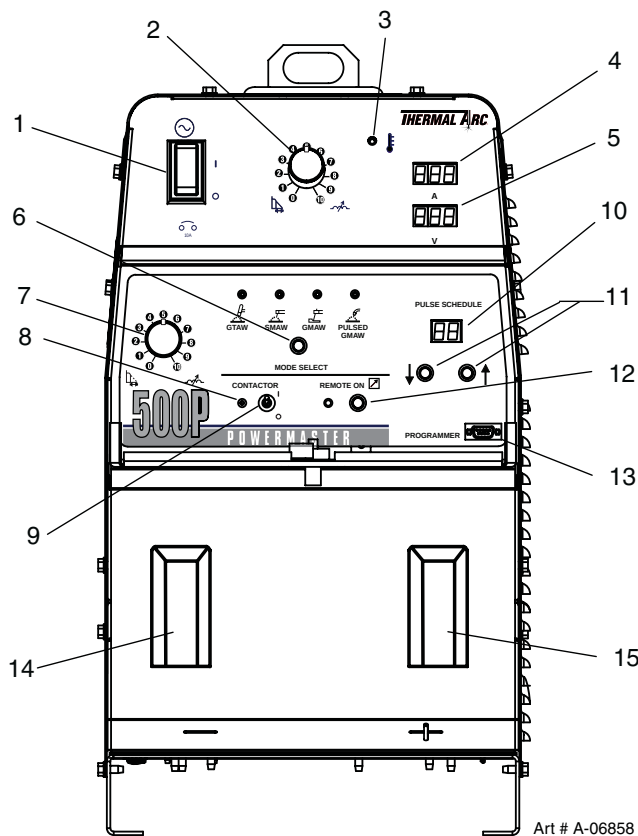


Figure 4-2: Power-Master 500P and 350P Front Panel

- 1. Control Power ON/OFF Switch:** This circuit breaker/switch activates the controls on the power source. When this switch is in the OFF position, the power source is in standby mode. Line voltage is still present internal to the machine, but the controls are not energized. In the ON position, power is applied to the control circuit of the power source. Whenever the switch is in the ON position, the digital meter displays are activated.

This circuit breaker also protects the auxiliary 24 VAC and 115 VAC power in case of an overload. If the circuit breaker trips, determine the cause of the overload before resetting.

- 2. Output Control:** This control is used to set the output voltage or amperage depending on the operating mode of the power source. For GTAW and SMAW modes, this control is used to preset the amperage. For GMAW this control presets the welding voltage. For Pulse GMAW this control sets the pulse reference, which is similar in function to a voltage control.

This control becomes inactive if REMOTE control is selected, except for GTAW mode. In GTAW mode this control is used to set the maximum welding current available to the remote control.

- 3. Overtemp Indicator:** This indicator light will be on if the power source has overheated. Whenever this light is on, the power source will be disabled from welding, but the fans will continue to run to cool the unit. Once the power source cools down, this light will automatically go off and the unit will be ready to weld. If this light comes on, the cause of the overheating condition should be investigated and resolved before continuing.
- 4. Amps Display:** The top display shows preset amperage for GTAW and SMAW modes when not welding. This display shows the actual welding current for all modes while welding. For GMAW and Pulsed-GMAW modes, the meter will hold the last value at the end of the weld for up to 5 seconds.
- 5. Volts Display:** The bottom display shows preset voltage for GMAW, and preset pulse reference for Pulsed-GMAW, when not welding. The display will show actual welding voltage for all modes while welding. For GMAW and Pulsed-GMAW modes, the meter will hold the last value at the end of the weld for up to 5 seconds.
- 6. Mode Select Switch:** The mode select switch is used to select one of the four built in operating modes of the power source. One of the four indicator lights located above the switch should be on at all times, indicating the mode which is currently selected. The four modes are as follows:

GTAW mode: In this mode the power source operates in constant current mode. The front panel control can be used to preset the welding amperage. If a foot pedal or other remote control is used, then the front panel control is used to set the maximum welding current available to the foot pedal. For GTAW mode the arc force control is not active.

A lift arc circuit is automatically activated for GTAW mode, unless disabled internally by jumper selections on the control board (See installation chapter for jumper settings). The lift arc circuit allows the arc to be initiated by momentarily touching the tungsten to the work and then lifting or rocking the tungsten off the work. The lift arc circuit limits the "touch" current to a low value and then switches to the preset current after the arc is struck.

SMAW mode: In this mode the power source operates in constant current mode. The front panel control can be used to preset the desired welding amperage. The arc force control is activated for SMAW mode allowing the amount of “dig” or arc force to be set by the arc force control. Maximum arc force is full clockwise, full counter clockwise is zero arc force.

GMAW mode: In this mode the power source operates in constant voltage mode. The front panel control can be used to preset the desired welding voltage. The inductance control is activated for GMAW mode. The inductance control allows the arc characteristics to be adjusted. Maximum inductance is full clockwise. Higher inductance settings make the arc “softer” with less spatter. Lower inductance settings give a stronger “driving” arc. Generally the inductance control can be set at mid range as a good starting point.

The GMAW mode also has a built in wire-sharpening circuit to help condition the end of the wire at the end of the weld. This feature reduces the size of the ball on the end of the wire to improve the next arc start. The wire sharp settings can be modified or disabled by using the programmer interface.

PULSED GMAW mode: In this mode the power source uses the built in pulse control for pulsed GMAW welding. The pulse control is factory programmed with 24 different pulse weld schedules. The active pulse schedule is shown on the pulse schedule display. The label on the inside of the control door shows the pulse schedules as shipped from the factory. Schedules 1 - 12 are programmed as standard (non AVC) and schedules 13-24 are programmed as AVC schedules. The AVC schedules provide for control of the arc length as the torch to work distance is varied. In the pulsed GMAW mode the front panel output control is used to preset a pulse reference for the pulse control circuit. The pulse schedules can be modified by using the programmer interface.

- 7. Arc Force/Inductance Control:** When the SMAW mode is selected this control is activated and allows adjustment of the amount of arc force or “dig”. Maximum arc force is full clockwise, full counter clockwise is zero arc force. For GMAW mode this control can be used to adjust the amount of “inductance” in the circuit. Higher inductance settings make the arc “softer” with less spatter. Lower inductance settings give a stronger “driving” arc. Generally the inductance control can be set at mid range as a good starting point. For GTAW and PULSED-GMAW modes, this control is not active.
- 8. Contactor On Indicator:** This indicator light is on whenever the output of the power source is energized, either by the contactor switch on the front panel or by the remote gun switch signal.
- 9. Contactor Switch:** This switch can be used to energize the output of the power source, when a remote gun switch is not being used. This switch would primarily be used for SMAW welding or GTAW welding without a remote pendant or foot pedal.
- 10. Pulse Schedule Display:** This two digit display shows the current selected pulse GMAW welding schedule. The current schedule can be changed by using the schedule up and down select buttons.
- 11. Pulse Schedule Select Buttons:** These two buttons can be used to select one of the built in pulse GMAW welding schedules. These buttons can only be used to change the pulse schedule when the output contactor is off, see description 8 above.
- 12. Remote On Selector:** This button allows the selection of either remote control of the output or local (front panel) control of the output. The indicator light next to the switch will be on if remote control is selected, and off if local control is selected. Remote control is via either the 19 pin or 14 pin receptacle on the rear panel of the power source.
- 13. Programmer Port:** This port allows the connection of the power source to a computer for accessing the programmable features of the power source. This port is configured for direct connection to a serial port on a computer.
- 14. Output Negative Terminal:** Connection point for negative welding lead.
- 15. Output Positive Terminal:** Connection point for positive welding lead.

4.04 Rear Panel (All Models)

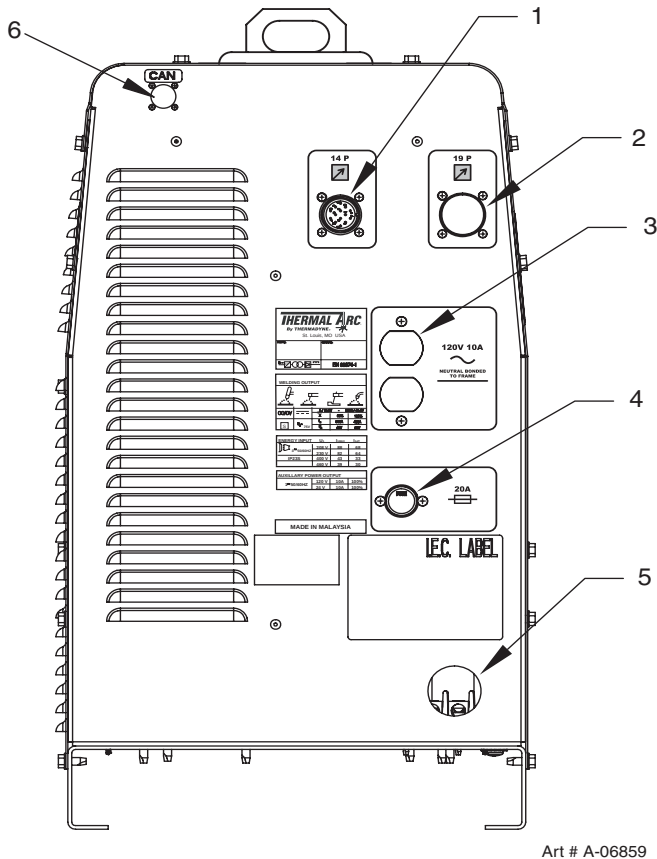


Figure 4-3: Rear Panel

1. 14 Pin Receptacle: This receptacle allows the power source to interface with wire feeders, and remote controls such as a foot pedal. This receptacle provides auxiliary power, contactor control for energizing the output of the power source, and remote output control. The pinout is as follows:

- A) 24 VAC auxiliary power high side
- B) 24 VAC Contactor circuit, (closure between pin A and pin B will energize output).
- C) Remote control maximum (top side of remote pot.)
- D) Control circuit common
- E) Remote control in (wiper of remote pot., 0 to 10 Volts). CV mode: 0 to 10 Volts gives 10 – 44 Volts of output. CC mode: 0 to 10 Volts gives 5 – 560 Amps of output.
- F) Scaled output current signal: $I_{fb} = 100 \text{ Amps/Volt}$

- G) 24/115 VAC neutral
- H) Scaled output voltage signal: 10 Volts/Volt
- I) 115 VAC auxiliary power high side
- J) 115 VAC Contactor circuit, (closure between pin I and pin J will energize output).
- K) Chassis ground
- L) N/C
- M) N/C
- N) N/C

2. 19 Pin Receptacle: This receptacle allows the power source to interface with wire feeders, and remote controls such as a foot pedal. This receptacle provides auxiliary power, contactor control for energizing the output of the power source, and remote output control. The pinout is as follows:

- A) Contactor circuit (+15 Volts)
- B) Contactor circuit in, (closure between pin A and pin B will energize output).
- C) Scaled output voltage signal: $V_{fb} = 10 \text{ Arc Volts/Volt}$
- D) 24 VAC auxiliary power high side
- E) 115 VAC auxiliary power high side
- F) 24/115 VAC neutral
- G) Chassis ground
- H) Remote control maximum (top side of remote pot.)
- J) Remote control in (wiper of remote pot., 0 to 10 Volts). CV Mode: 0 to 10 Volts gives 0 – 44 Volts of output. CC Mode: 0 to 10 Volts gives 0 – 560 Amps of output.
- K) Remote control minimum (bottom side of remote pot.)
- L) Control circuit common
- M) Arc Established = +12 Volts
- N) Control circuit common
- P) 24 VAC auxiliary power high side (same as pin D)
- R) 24/115 VAC neutral (same as pin E)
- S) N/C
- T) N/C

U) Scaled output current signal: $I_{fb} = 100 \text{ Amps/Volt}$

V) N/C

If a remote control is plugged into both the 14 pin and 19 pin receptacles the device plugged into the 19 pin receptacle will have control over the output current or voltage. Either device can control the output contactor circuit.

3. **Duplex Receptacle:** This receptacle can provide up to 10 amps of 120 VAC auxiliary power for powering wire feeders, water circulators, etc.
4. **Fuse:** This fuse protects the control circuit in the power source. If the fuse opens it should be replaced with a like amperage and voltage, (20 amps, 600VAC).
5. **Input Power Access:** This opening provides access to the input terminal block for the input cable. Refer to the installation chapter of this manual for detailed instructions.
6. **CAN Port (PowerMaster 500P and 350P only):** This serial port is used for connection to a CAN compatible Thermal Arc wire feeder or other auxiliary device. All of the programmable features of the power source can be accessed via this port.

4.05 GTAW (Gas Tungsten Arc Welding)

1. Connect the work lead to the positive terminal and the torch to the negative terminal of the power source (normal connection for DCEN).
2. Provide suitable shielding gas connections and controls to the torch. The power source does not provide connections for the shielding gas.
3. Select the proper tungsten size and type for the job.
4. If a foot pedal or torch control is being used, connect to the 14 or 19-pin remote receptacle on the rear of the power source.
5. Turn the control power switch ON, located on the front panel of the power source. The digital display on the power source should be activated.
6. Set the front panel mode switch to GTAW.
7. Preset the weld amperage using the front panel AMPS/VOLTS control, by placing the meter amps/volts switch in the amps position, and the LOCAL/REMOTE switch in the LOCAL position.
8. If a foot pedal or torch amperage control is being used, place the local/remote switch in the remote position (after presetting the maximum desired amperage). The digital meter will now display the foot/torch control amperage. Until the foot pedal is pressed, the meter will display the minimum amperage.
9. If a remote control is not being used, it will be necessary to turn the output contactor ON/OFF switch to the ON position to energize the output of the machine. Open circuit voltage will now be present on the output terminals of the power source.
10. Gently rest the torch cup on the workpiece.
11. Press the foot pedal or torch switch to energize the output, if being used.
12. Rock the torch until the tungsten briefly touches the workpiece. This will initiate the "LIFT-ARC" feature. Lift or rock the tungsten back off of the work to initiate the arc. During the time the tungsten is touching the work, the power source will automatically limit the weld current to around 20 amps. Once the arc is initiated, the weld amperage will change to the preset value (or foot pedal value). To minimize heating of the end of the tungsten, it should be left in contact with the workpiece only briefly.
13. To end the weld, release the foot pedal or turn off torch switch if being used. Turn off shielding gas supply.

4.06 SMAW (Shielded Metal Arc Welding)

1. Connect the welding leads to the output terminals of the power source. Normally the work lead should connect to the negative lead and the electrode holder to the positive terminal (DCEP or reverse polarity).
2. If a remote control is being used, connect to the 14 or 19-pin remote receptacle on the rear of the power source.
3. Turn the control power switch ON, located on the front panel of the power source. The digital display on the power source should be activated.
4. Set the front panel mode switch to SMAW.
5. Preset the weld amperage using the front panel amps/volts control, by placing the meter amps/volts switch in the amps position, and the local/remote switch in the local position.
6. If a remote control is being used, place the local/remote switch in the remote position. The remote control will have full control of the output of the power source from minimum to maximum.
7. Set the arc force control to the desired setting. Fully counter-clockwise is off, full clockwise is maximum. Higher arc force settings will give the arc more "dig" or "drive" by increasing the short circuit current available.
8. Energize the output of the power source with either the front panel output contactor ON/OFF switch or by the switch on the remote control if one is being used. Open circuit voltage will now be present on the output terminals of the power source.
9. The power source is now ready to weld.

4.07 CAG (Carbon Arc Gouging)

1. Connect the welding leads to the output terminals of the power source. Normally the work lead should connect to the negative lead and the electrode holder to the positive terminal (DCEP or reverse polarity).
2. If a remote control is being used, connect to the 14 or 19-pin remote receptacle on the rear of the power source.
3. Turn the control power switch ON, located on the front panel of the power source. The digital display on the power source should be activated.
4. Set the front panel mode switch to CAG.
5. Preset the weld amperage using the front panel amps/volts control, by placing the meter amps/volts switch in the amps position, and the local/remote switch in the local position.
6. If a remote control is being used, place the local/remote switch in the remote position. The remote control will have full control of the output of the power source from minimum to maximum.
7. Energize the output of the power source with either the front panel output contactor ON/OFF switch or by the switch on the remote control if one is being used. There will now be open circuit voltage present on the output terminals of the power source.
8. The power source is now ready to arc gouge.

NOTE

For CAG mode, the arc force/inductance control is not active. The optimum arc characteristics are built into the power source.

4.08 GMAW (Gas Metal Arc Welding)

1. Connect the wire feeder to the power source. Connect the control cable to the 19-pin receptacle or the 14-pin receptacle on the rear of the power source. Connect the electrode cable from the wire feeder to the output terminal of the power source (normally positive for DCEP). Connect the other output terminal of the power source to the workpiece.
2. Turn the control power switch ON, located on the front panel of the power source. The digital display on the power source should be activated.
3. Set the front panel mode switch to GMAW.
4. Preset the weld voltage using the front panel amps/volts control, by placing the meter amps/volts switch in the volts position, and the local/remote switch in the local position.
5. If the wire feeder has remote voltage control, place the local/remote switch on the front of the power source in the remote position. This will allow the wire feeder to control the preset voltage of the power source.
6. Set the inductance control to the desired inductance setting. Full clockwise is maximum inductance. Higher inductance settings make the arc “softer” with less spatter. Lower inductance settings give a stronger “driving” arc. The inductance should be set according to the type of wire and gas and desired arc characteristics desired. Generally, the inductance control can be set at mid-range as a good starting point.

NOTE

The inductance control is primarily used for the short-circuiting transfer mode of MIG welding. For globular or spray transfer modes the inductance control has minimal effect.

7. The power source is now ready to weld.
8. To end the weld, release the torch switch while holding the torch in place at the end of the weld. This will allow the wire sharpening circuit in the power source to condition the end of the wire for the next weld. The wire sharpening circuit will tend to leave a very small ball on the end of the wire, thus making the next start easier.

4.09 Pulsed GMAW (Power-Master 500P and 350P Only)

1. Connect the wire feeder to the power source. Connect the control cable to the 19-pin receptacle or the 14-pin receptacle on the rear of the power source. Connect the electrode cable from the wire feeder to the output terminal of the power source (normally positive for DCEP). Connect the other output terminal of the power source to the workpiece.
2. Turn the control power switch ON, located on the front panel of the power source. The digital display on the power source will be activated.
3. Select Pulsed GMAW mode using the mode select switch located on the control panel under the door.
4. Select the desired pulse schedule based on the wire size and type. The label on the inside of the door shows the default factory pulse schedules. Schedules 1-12 are standard pulse schedules, schedules 13-24 are AVC type pulse schedules. The AVC schedules provide for greater control of the arc length as the torch to work distance varies.

NOTE

Any or all of the pulse schedules can be modified using the programmer interface and the programming software.

5. Preset the pulse reference. The reference can be between 0 and 440. This is just a reference to the pulse control circuit and is not a preset of the actual arc voltage or amperage. The reference controls the pulse rate. The pulse rate can be considered similar to voltage for conventional GMAW. A higher reference gives a longer arc with higher voltage and heat input. As with conventional GMAW, the power source must be adjusted to correspond with the correct heat input for a given wire feed speed.
6. If the wire feeder has remote voltage control, place the power source in remote mode using the remote switch located on the control panel under the door. This will allow the wire feeder to control the preset voltage of the power source.
7. The power source is now ready to weld.

8. To end the weld, release the torch switch while holding the torch in place at the end of the weld. This will allow the wire sharpening circuit in the power source to condition the end of the wire for the next weld. The wire sharpening circuit will tend to leave a very small ball on the end of the wire, thus making the next start easier.

SECTION 5: MAINTENANCE

If this equipment does not operate properly, stop work immediately and investigate the cause of the malfunction. Maintenance work must be performed by an experienced, qualified person only. Any electrical work must be performed by an electrician or other person properly trained in servicing electrical equipment. Do not permit untrained persons to inspect, clean or repair this equipment. Use only recommended replacement parts when servicing this machine.



Danger: HIGH VOLTAGE is present internally even with the control power switch in the OFF position. Before inspecting, cleaning, or servicing, disconnect and lock out the input power to the power source.

Periodically clean the inside of the welding power source by using clean dry compressed air of not over 25 psi as normal preventive maintenance. At the time of the cleaning, a full inspection of the welding machine and setup should be performed.

The following checklist can be used as a guide for routine maintenance.

- Check warning labels for readability.
- Check sheet metal panels, all screws and fasteners should be firmly secured, heavily corroded panels and fasteners or damaged panels should be replaced.
- Check primary input power wiring to the machine including ground. Repair or replace any wires that have cracked or damaged insulation or frayed connections.
- Check output weld connections including any connections to wire feeders, fixtures, etc. Loose or frayed connections can cause overheating of the output terminals, or excessive voltage drop which may degrade welding performance.
- Check control cable connections to the power source and wire feeder or other controls. Damaged cables can cause intermittent problems which are often difficult to troubleshoot. Cables should be repaired or replaced if damage is evident.
- Check all control switches and potentiometers. If any of the controls are damaged or broken they should be replaced. Most of the controls on this machine are integral components to a circuit board, and will require replacement of the board.
- Inspect internal wiring of the welding machine for loose or frayed connections, tighten or repair as necessary.
- Check internal connections including circuit board connectors. Any loose or corroded connections should be repaired

Warning!
Disconnect input power before maintaining.

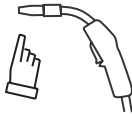
Maintain more often
if used under severe
conditions

Each Use

Visual check of
regulator and pressure

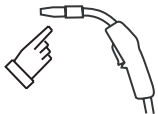


Visual check of torch
Consumable parts

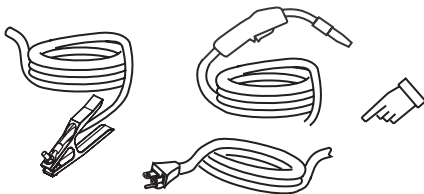


Weekly

Visually inspect the torch
body and consumables

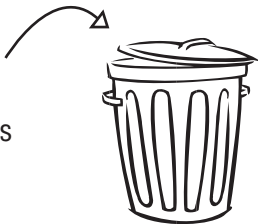


Visually inspect the
cables and leads.
Replace as needed



3 Months

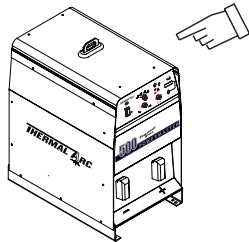
Replace all
broken parts



Gas and
air lines

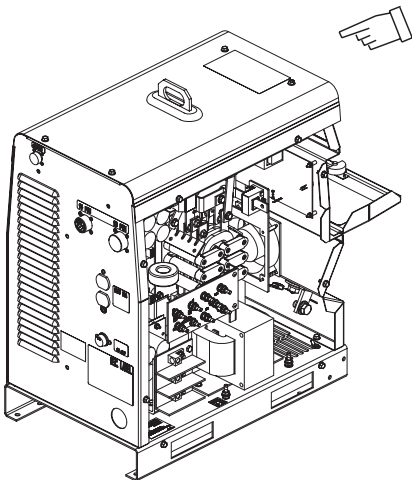
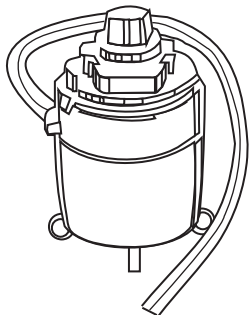


Clean
exterior
of power supply



6 Months

Visually check and
use a vacuum to carefully
clean the interior



SECTION 6: TROUBLESHOOTING

6.01 General

This manual is intended to be used by qualified, trained, service technicians. Its purpose is to give the service technician an enhanced, detailed understanding of the welding machine.

This troubleshooting section is intended to help determine which component or sub-assembly is faulty. This manual only provides information to the point of determining whether a circuit board is defective, it does not provide information to troubleshoot and repair a circuit board.

There are many outside influences on the overall welding process which can often point towards a “defective” welding power source. It is important to make sure that these outside influences are not the actual cause of a complaint or faulty operation before troubleshooting the welding power source.

Some common things to look for are listed below:

Input Power

Incorrect voltage, blown fuses, loose connections, improper voltage changeover setting.

Improper Operation

Incorrect switch positions (remote/local, mode, trigger hold, voltage or wire feed setting, inductance setting, pulse schedule, etc.), Loose, damaged or missing control or weld connections.

NOTE

The Power-Master 500P has a number of programmable features, including the ability to disable front panel switches and limit the output range of the machine. These features can be programmed using an optional software package (GUS).

Poor Welding Or Starting

Shielding gas type, flow or contamination, incorrect weld polarity, wire feeding problem (liner, feed rolls, tip, guides, etc.), Torch to work distance incorrect, travel speed, torch angle, etc.

6.02 Basic Troubleshooting

There are two general types of problems or failures which can occur with the Power-Master. The first would relate to a failure within the power circuit, and the second would be a control type problem.

Power Circuit failure

Typical symptoms:

- Blown line fuses
- No output
- Visual damage to power components

Diagnostics:

- Check input rectifier
- Check IGBT modules
- Check output diodes
- Check capacitor boards
- Check input contactors for damaged contacts

Control circuit failure

Typical symptoms

- Lack of output control
- Improper operation
- Erratic welding (rule out external causes first)

Diagnostics:

Refer to block diagram, control board signal information and specific control tests to pinpoint trouble.



WARNING

Disconnect the power source from the input power source before carrying out any service or repair work. Hazardous voltages can be present in the machine whenever input power is connected.



WARNING

**ALL SERVICE SHOULD BE PERFORMED BY
TRAINED PERSONNEL ONLY.**

6.03 Troubleshooting Guide

This guide should be used as an aid to determine the cause of a system malfunction or failure. It should be remembered that in most welding situations there can be a large number of variables which can affect the overall system performance. These variables often include several pieces of equipment, interconnect cables, weld cables, shielding gas systems, grounding, consumable wire or electrodes, part preparation, etc. It is important to check all aspects of the welding system and environment when troubleshooting a problem or malfunction.

Explanation of front panel lights:

OUTPUT CONTACTOR ON – GREEN

This light indicates that either the OUTPUT CONTACTOR switch on the front panel is on, or the remote GUN SWITCH is on via either the 14 pin or 19 pin remote receptacle. Whenever this green light is on, the machine should be producing output.

OVERTEMPERATURE – AMBER

This light indicates that the machine has overheated and shut itself off. When this light is on, the machine will be disabled and not produce any output. After the machine has cooled, this light will automatically turn off and the machine will no longer be disabled.

The following guide lists several potential problems and lists a number of items to check or possible causes.



DANGER

ELECTRIC SHOCK CAN KILL

Open the main wall disconnect switch or breaker, before removing any covers or access panels on the welding machine. Live voltage is still present even with the front panel control switch OFF. Wait at least three full minutes after power has been removed before removing any covers or access panels to allow adequate time for internal capacitors to discharge.

1. **Unit is completely inoperative – digital display is off, fans are off, no output.**
 - A. *Check for blown input fuse or fuses.*
 - B. *Check to make sure that voltage setting on changeover board is correct*
 - 1) Check all of the LINKS to make sure they are set right.
 - 2) Check fuse on the rear panel.
 - C. *Check wiring to the input terminal block and ground screw.*
 - D. *Is front panel CONTROL POWER switch/circuit breaker ON?*
 - E. *With CONTROL POWER switch ON and power applied to the machine check for 115 VAC power on the rear duplex.*
 - F. *Check the following internal to the machine.*
 - 1) *All connections to the control boards.*
 - 2) *Wiring to the small control transformer mounted underneath the control board.*
 - G. *Possible defective circuit breaker switch on front panel.*
 - H. *Possible defective main control board.*
 - I. *Possible defective display board.*
2. **Machine blows input fuse as soon as power is applied.**
 - A. *Check wiring to input terminal block and ground screw.*
 - B. *Check to make sure that voltage setting on changeover board is correct.*
 - 1) Check the LINKS to make sure they are set right.
 - 2) Check fuse on the rear panel.
 - C. *Check internal wiring to terminal block, input rectifier, IGBTs, contactors and changeover board.*
 - D. *Possible defective input rectifier module and/or suppressors. (See how to check the input rectifier module below).*
 - E. *Possible defective IGBT modules. (See how to check IGBT module below).*
 - F. *Possible defective capacitor board/s.*

3. Machine powers up but fans do not run.

- A. *Fans should normally run when the machine is first powered up or whenever the OUTPUT CONTACTOR is ON.*
- B. *With CONTROL POWER switch ON check for 115 VAC power on the rear duplex.*
- C. *Check wiring to all three fans.*
- D. *Check wiring to main control board – J9.*
- E. *Possible defective main control board.*
- F. *Possible defective fan/s.*

4. CONTROL POWER circuit breaker trips off.

- A. *Check for shorts or overload on either rear duplex, 14 pin receptacle or 19 pin receptacle and cables.*
- B. *Check for internal short circuit, check wiring to both contactors, all three fans and to main control board – J9.*
- C. *Check internal wiring to rear duplex, amphenol board and small control transformer.*
- D. *Possible defective front panel circuit breaker.*
- E. *Possible defective small control transformer or aux. transformer.*

5a. Machine powers up but no output or incorrect output (Power-Master 500 and 350 only).

- A. *Check for open circuit voltage (see how to test open circuit voltage below).*
- B. *Check for shorted output diode (see how to check output diodes below).*
- C. *Check front panel controls:*

1) Adjust ranges:

To check the output adjust range make sure that the REMOTE/LOCAL control is set to local. For GTAW, SMAW and CAG modes the Meter Amps/ Volts switch must be in the AMPS position. For GMAW mode, the switch must be in the VOLTS position.

- a) GTAW range: 5 - 560 (AMPS display)
- b) SMAW range: 5 - 560 (AMPS display)
- c) CAG range: 5 - 560 (AMPS display)
- d) GMAW range: 0 - 44.0 (VOLTS display)

2) CONTACTOR control:

Whenever the CONTACTOR switch is ON the indicator LED should also be on. Anytime the CONTACTOR is on, there should be open circuit voltage present on the output terminals of the power source. Open circuit voltage should be approximately 50 - 70 volts for all operating modes of the power source except GMAW. For checking open circuit voltage in GMAW mode, use an external CONTACTOR control.

NOTE

For load testing the machine or welding in GMAW mode it will be necessary to use an external CONTACTOR signal, otherwise the machine will NOT produce the correct output voltage.

- D. *Possible defective main control board.*
- E. *Possible defective IGBT or input rectifier module (See how to check these parts below).*
- F. *Check internal wiring to control board and current sensor.*
- G. *Possible defective current sensor.*

5b. Machine powers up but no output or incorrect output (Power-Master 500P and 350P only).

- A. *Check for open circuit voltage (see how to test open circuit voltage below).*
- B. *Check for shorted output diode (see how to check output diodes below).*
- C. *Check front panel controls:*

NOTE

If some of the controls appear not to function as described below, they may have been locked out or restricted using the programming software. In this case it will be necessary to connect a computer to the programmer interface on the power source and use the programming software to re-enable these controls.

1) MODE SELECT:

Each time the mode switch is pressed and released the power source should advance to the next mode as indicated by one of the LEDs.

2) REMOTE/LOCAL control:

Each time the REMOTE ON switch is pressed and released the associated indicator LED should toggle between ON and OFF. If the LED is ON this indicates that the power source is set for remote control.

3) Schedule UP and DOWN controls:

Each time the switch next to the UP arrow is pressed the PULSE SCHEDULE should increase by one, until it reaches 24 and rolls back over to 1. The switch next to the DOWN arrow should work in a similar way except that the PULSE SCHEDULE should decrease.

4) Adjust ranges:

To check the output adjust range make sure that the REMOTE/LOCAL control is set to local, (the indicator LED should be OFF).

- a) GTAW range: 5 - 560 (AMPS display)
- b) SMAW range: 5 - 560 (AMPS display)
- c) GMAW range: 10 - 44 (VOLTS display)
- d) PULSED GMAW range: 0 - 440 (VOLTS display)

5) CONTACTOR control:

Whenever the CONTACTOR switch is ON the indicator LED should also be on. Anytime the CONTACTOR is on, there should be open circuit voltage present on the output terminals of the power source. Open circuit voltage should be approximately 50 - 70 volts for all operating modes of the power source except GMAW. For checking open circuit voltage in GMAW mode, use an external CONTACTOR control.

NOTE

For load testing the machine or welding in GMAW mode it will be necessary to use an external CONTACTOR signal, otherwise the machine will NOT produce the correct output voltage.

- D. Possible defective main control board.*
- E. Possible defective IGBT or input rectifier module (see how to check these parts below).*
- F. Check internal wiring to control board and current sensor.*
- G. Possible defective current sensor.*

6. How to check the input rectifier module.

- A. See Figure 6-1 and/or Appendix 3 Connection Diagram.*
- B. Check all six internal diodes as follows with diode checker on DVM (all should read in the range of 0.3 to 0.6 volts).*
 - 1) Positive meter lead on AC terminal A(1), negative meter lead on (+) terminal D(4).
 - 2) Positive meter lead on AC terminal B(2), negative meter lead on (+) terminal D(4).
 - 3) Positive meter lead on AC terminal C(3), negative meter lead on (+) terminal D(4).
 - 4) Positive meter lead on (-) terminal F(5), negative meter lead on AC terminal A(1).
 - 5) Positive meter lead on (-) terminal F(5), negative meter lead on AC terminal B(2).
 - 6) Positive meter lead on (-) terminal F(5), negative meter lead on AC terminal C(3).

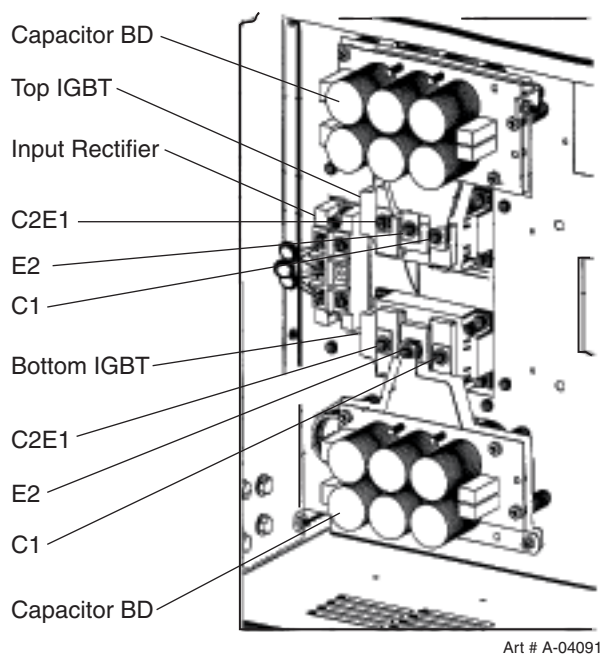


Figure 6-1: Input Rectifier IGBT Modules

7. How to check the IGBT modules.

- A. Refer to Figure 6-1 and/or Appendix 3 Connection Diagram.
- B. Using diode checker on digital VOM make the following checks: (all should read in the range of 0.3 to 0.6 volts).
 - 1) Top IGBT: Positive meter lead on terminal C2E1, negative meter lead on terminal C1.
 - 2) Top IGBT: Positive meter lead on terminal E2, negative meter lead on terminal C2E1.
 - 3) Bottom IGBT: Positive meter lead on terminal C2E1, negative meter lead on terminal C1.
 - 4) Bottom IGBT: Positive meter lead on terminal E2, negative meter lead on terminal C2E1.

8. How to check the output diodes.

- A. Disconnect the weld cables from output terminals.
- B. With diode checker setting on DVM, measure across output terminals with positive meter lead on negative output terminal. Diode checker should indicate 0.2 to 0.6 volts. If diode checker indicates short, then one or more of the output diodes is shorted.

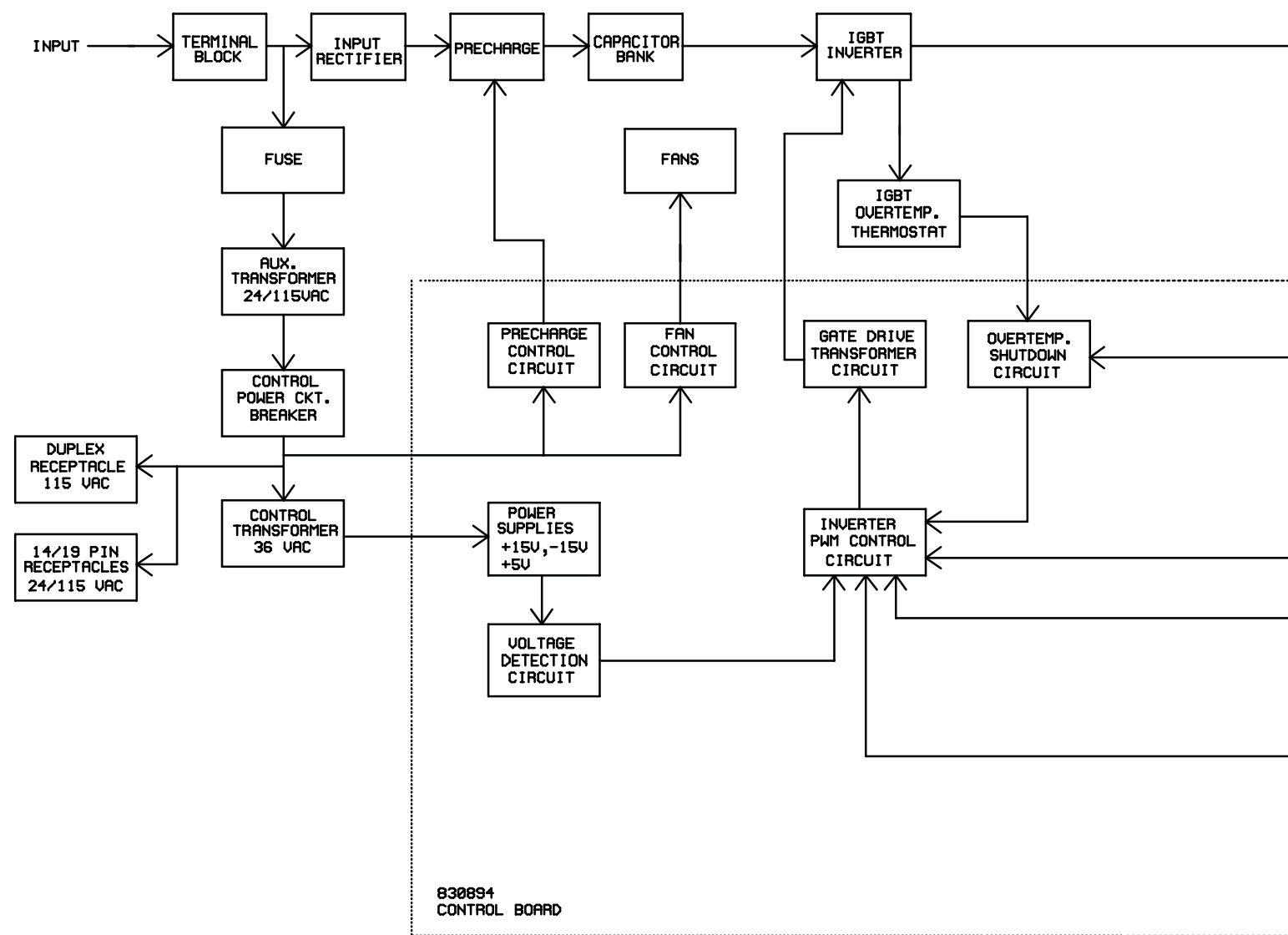
9. How to check output open circuit voltage.

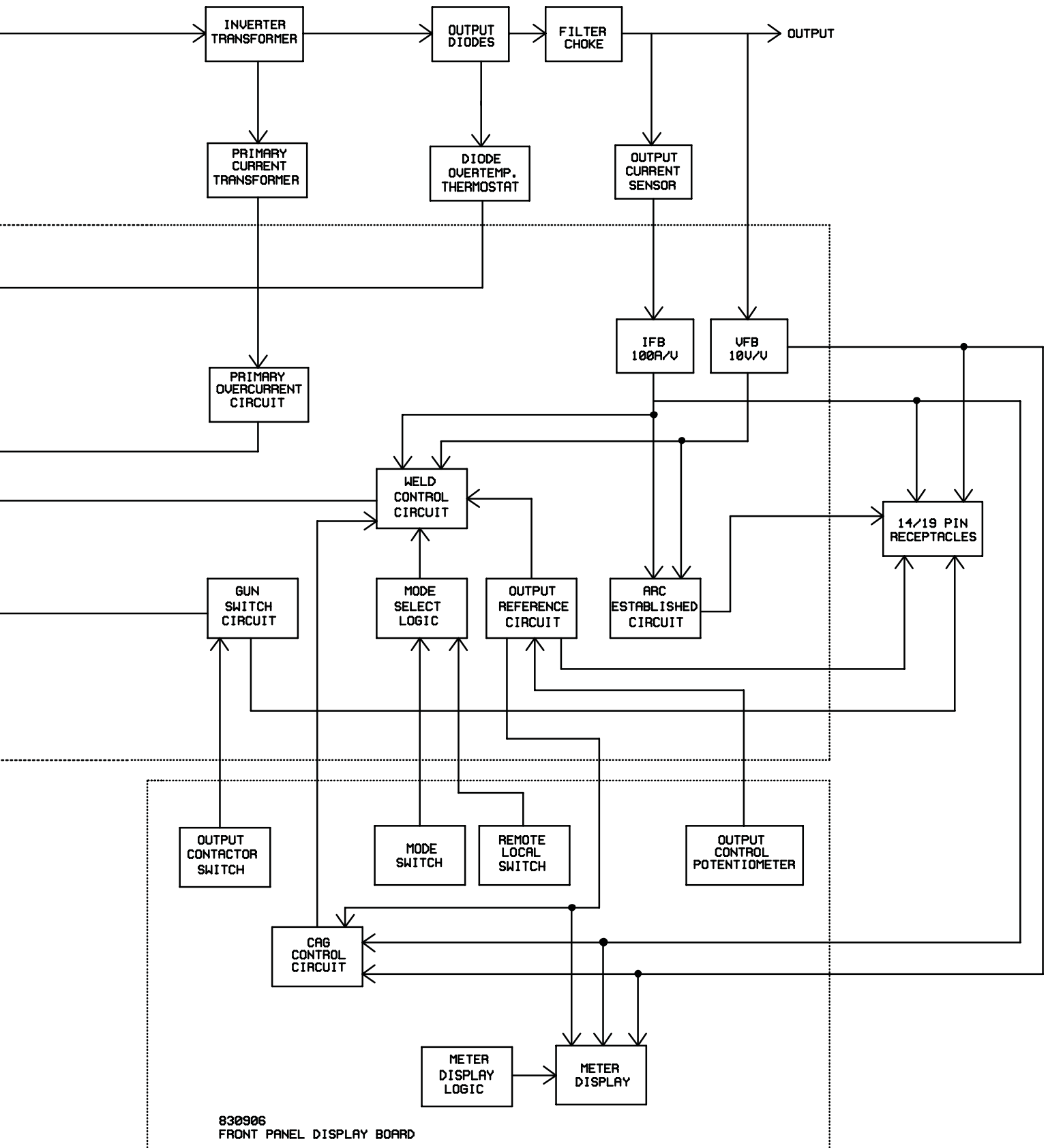
- A. Disconnect the weld cables from output terminals.
- B. Place front panel mode switch in SMAW.
- C. Set to LOCAL mode and turn OUTPUT CONTACTOR switch ON.
- D. Measure output terminal voltage, should read approximately 55 to 70 VDC.

10. Erratic arc

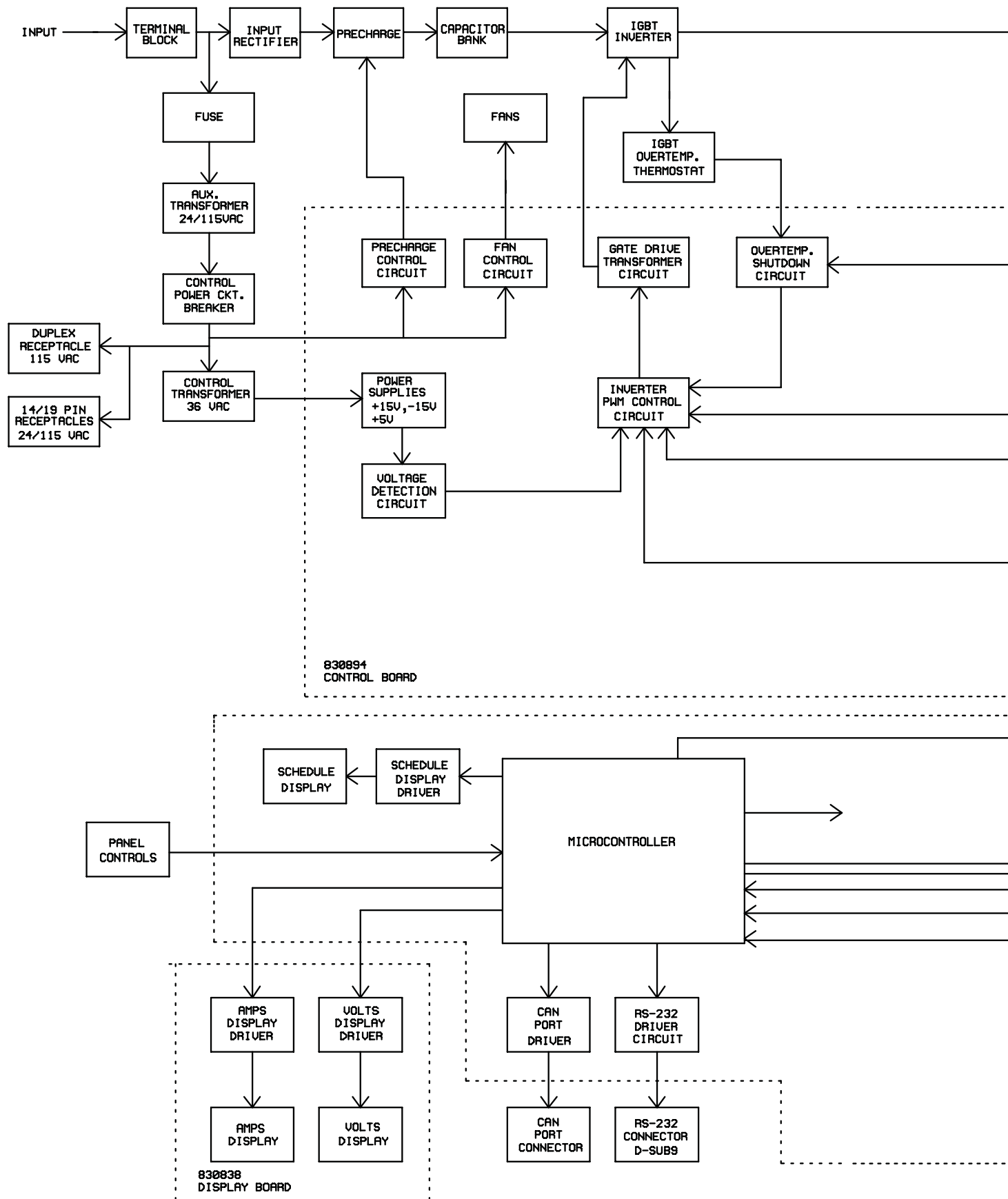
- A. Check for loose or incorrect polarity connection to electrode and work.
- B. Check for good gas flow and correct mixture.
- C. Is wire feeding smoothly? Check feed rolls, liner, tip, nozzle, etc.
- D. Check welding wire for excess lubrication or improper cast.
- E. Is electronic inductance set correctly, see Operation chapter of manual.
- F. Check voltage and wire speed settings.
- G. Torch to work distance too great.
- H. Possible defective main control board.

6.04 Power-Master 500 and 350 Block Diagram





6.05 Power-Master 500P and 350P Block Diagram





6.06 Control Board Connector Signals For 830894 Main Control Board

Connector	Voltage	Description
J1: 26 pin ribbon cable to front panel board		
J1-1	1V or 14V	GTAW mode select, 1V = GTAW selected
J1-2	1V or 14V	SMAW mode select, 1V = SMAW selected
J1-3	1V or 14V	CAG or PULSE mode selected, 1V = CAG or PULSE selected
J1-4	1V or 14V	GMAW mode selected, 1V = GMAW selected
J1-5		Arc force pot high side in SMAW mode
J1-6		Inductance pot high side in all modes except SMAW
J1-7		Arc force pot low side in SMAW mode
J1-8		Inductance pot low side in all modes except SMAW
J1-9	1V or 14V	Remote/Local, 1V = remote selected
J1-10	+15V	Power supply
J1-11	0V or 13.5V	Contactor input, +13.5V = inverter on
J1-12	+10V	High side reference for front panel control pot.
J1-13	0.07V or 2.22V	Low side of front panel pot., 2.22 for GMAW, .07 for other modes
J1-14	0 to 10V	Wiper input from front panel control pot.
J1-15	0 to 6V	Current feedback, 100Amps/volt
J1-16	0 to 6V	Voltage feedback, 10Volts/volt
J1-17	0 or 14V	Arc established signal, 14V = arc established
J1-18	0 or 15V	Gun Switch signal, +15V = gun switch on
J1-19	-15V	Power supply
J1-20	Common	Signal common
J1-21	+5V	Power Supply
J1-22		Over-temperature light drive
J1-23	0 to 10V	Reference output
J1-24	0 to 13.5V	Pulse or CAG control input
J1-25	Common	Signal common
J1-26	0 to 10V	Reference input to main board
J2: 4 pin connector to current sensor		
J2-1	+15V	Power supply to current sensor
J2-2	-15V	Power supply to current sensor
J2-3	0 to 5V	Output current, 4V = 500 Amps
J2-4	Common	Signal common for current sensor
J3: 2 pin connector for output voltage feedback		
J3-1	0 to +60V	Positive output terminal voltage
J3-2	0 to -60V	Negative output terminal voltage

Connector	Voltage	Description
J4: 12 position connector header for optional wire stick detect circuit		
J4-1	+5V	Power supply to wire detect circuit
J4-2	Common	Signal common
J4-3 to J4-10	N/C	
J4-11	0 to +60V	Positive output terminal
J4-12	0 to -60V	Negative output terminal
J5: 5 position to primary current transformer		
J5-1		Current transformer secondary
J5-2		Current transformer secondary
J5-3	N/C	
J5-4	+15V	Interlock jumper
J5-4	+15V	Interlock jumper
J6: 4 position to thermostats		
J6-1	+15V	Power to thermostats
J6-2	+15V	From thermostat, 15V for normal operation
J6-3	+15V	From thermostat, 15V for normal operation
J6-4	+15V	From thermostat, 15V for normal operation
J7: 8 position to IGBT gate drive		
J7-1 to J7-5	0 or 14 VAC	Gate drive signal #1
J7-4 to J7-8	0 or 14 VAC	Gate drive signal #2
J8: 8 position to IGBT gate drive		
J8-1 to J8-5	0 or 14VAC	Gate drive signal #3
J8-4 to J8-8	0 or 14 VAC	Gate drive signal #4
J9: 14 position to contactors and fans		
J9-1	0 or 115VAC	Main contactor coil drive
J9-3	0 or 115VAC	Inrush contactor coil drive
J9-5	115VAC neutral	Neutral common connection
J9-7	0 or 115VAC	Fan drive

6.06 Control Board Connector Signals For 830894 Main Control Board (con't)

Connector	Voltage	Description
J10: 16 position ribbon to amphenol board		
J10-1	+15V	Voltage supply to remote gun switch
J10-2	0 or +15V	Gun switch input, +15V = Gun switch on
J10-3	0 to 6V	Voltage feedback 10V/Volt
J10-4	0 to 10V	Remote control maximum
J10-5	0 to 10V	Remote control input from 19 pin
J10-6	0.07 or 2.22V	Remote control minimum, 2.22V for GMAW mode
J10-7	0 or 15V	Arc established signal, +15V = arc established
J10-8	0 to 6V	Current feedback 100 Amps/Volt
J10-9	Common	Control circuit common
J10-10	0 to 10V	Remote control input from 14 pin
J10-11	0 to 6V	Voltage feedback for 14 pin remote, 10V/Volt
J10-12 to J10-16	N/C	
J11: 4 position AC voltage to board		
J11-1	21VAC	Supply voltage
J11-2	21VAC	Supply voltage
J11-3	Common	Circuit common for supply voltages
J12: 5 position option connector		
J12-1	+15V	Supply voltage
J12-2	-15V	Supply voltage
J12-3	+5V	Supply voltage
J12-4	Common	Power supply common
J12-5	N/C	

6.07 Power Circuit Tests



HIGH VOLTAGE is present internally even with the control power switch in the OFF position. Before inspecting, cleaning, or servicing, disconnect and lock out the input power to the power source.

The following test must be performed with power disconnected from the machine. These tests require a DVM with a diode checker.

NOTE

Normally a good diode will check in the range of 0.2 to 0.9 Volts in the forward direction depending on the particular diode.

Input Rectifier Test

(see Figure 6-3 and connection diagram)

Terminal 4 (+) to terminal 1 (-) : Open

Terminal 4 (+) to terminal 2 (-) : Open

Terminal 4 (+) to terminal 3 (-) : Open

Terminal 4 (-) to terminal 1 (+) : 0.2 - 0.9

Terminal 4 (-) to terminal 2 (+) : 0.2 - 0.9

Terminal 4 (-) to terminal 3 (+) : 0.2 - 0.9

Terminal 5 (+) to terminal 1 (-) : 0.2 - 0.9

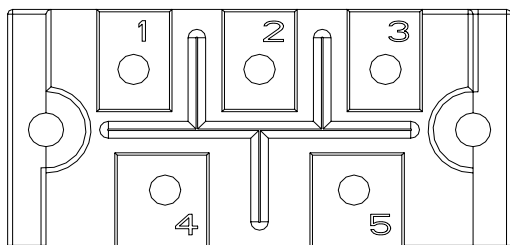
Terminal 5 (+) to terminal 2 (-) : 0.2 - 0.9

Terminal 5 (+) to terminal 3 (-) : 0.2 - 0.9

Terminal 5 (-) to terminal 1 (+) : Open

Terminal 5 (-) to terminal 2 (+) : Open

Terminal 5 (-) to terminal 3 (+) : Open



Art # A-07546

Figure 6-2 Input Rectifier

IGBT Test: (See Figure 6-4 and connection diagram).

NOTE

Because of the capacitor boards connected across the IGBTs they may initially show a short circuit when using the diode checker, until the capacitors charge up.

Check both IGBTs as follows:

E2 (+) to C2E1 (-): 0.2 - 0.9

E2 (-) to C2E1 (+): Open (See Note above)

C2E1 (+) to C1 (-): 0.2 - 0.9

C2E1 (-) to C1 (+): Open (See Note Above)

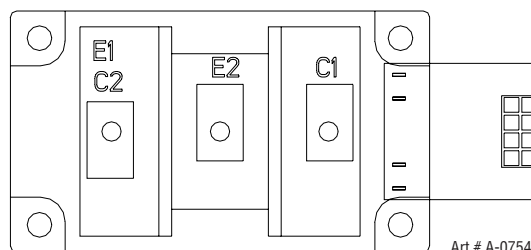


Figure 6-3 IGBT Module

Output Diode test:

Check the output diodes at the output weld terminals as follows:

Positive terminal (+) to Negative terminal (-): Open

Positive terminal (-) to Negative terminal (+): 0.2 - 0.9

Capacitor Board tests:

The capacitors can be checked using the diode checker function on a DVM, with the power disconnected from the machine. A good capacitor will initially show a short and then go to an open circuit as the capacitor charges up. If the meter leads are then reversed the capacitor will again show a short and go to an open as the capacitor charges with the opposite polarity.

NOTE

Check the IGBTs and input rectifier first. If an IGBT is shorted it will have to be disconnected from the capacitor board before the capacitor can be checked.

Check the four capacitor banks using the diode checker function on the meter with power disconnected from the machine as follows:

C1 to C2E1 top IGBT.

C2E1 to E2 top IGBT.

C1 to C2E1 bottom IGBT.

C2E1 to E2 bottom IGBT.

The capacitor banks should have the follow voltage readings when power is applied to the unit, by switching the front panel CONTROL POWER switch ON.

NOTE

The voltage must be checked with the OUTPUT CONTACTOR control OFF.

C1(+) to C2E1(-) top IGBT: 140 to 180 VDC

C2E1(+) to E2(-) top IGBT: 140 to 180 VDC.

C1(+) to C2E1(-) bottom IGBT: 140 to 180 VDC.

C2E1(+) to E2(-) bottom IGBT: 140 to 180 VDC.

All readings should be within 15 VDC of each other.



DANGER:

Use extreme caution when making measurements internal to the machine. Primary voltage is present inside the machine even with the CONTROL POWER switch in the OFF position. Do not touch exposed metal or wiring connections if the main wall disconnect is activated. After power has been removed allow 2 minutes for the voltage to decay on the capacitor banks.

6.08 Semiconductor Replacement Requirements

The following guidelines must be followed when replacing one of the power semiconductors. This includes the input rectifier module, output diode, or IGBT module.

- 1. Remove the failed component and thoroughly clean the heat sink area where the part mounts.
- 2. Apply a thin layer of heat sink thermal compound to the semiconductor module.
- 3. Tighten and torque the mounting screws and terminals per the chart below.

NOTE

It is important to follow the torque requirements to avoid possible damage to the component.

Component	Torque
Output Diode	
Center mounting screw	15 in-lbs
Outer mounting screws	35 in-lbs
Terminal screws	35 in-lbs
Input Rectifier	
Mounting Screws	27 in-lbs
Terminal Screws	27 in-lbs
IGBT Module	
Mounting Screws	35 in-lbs
Terminal Screws	27 in-lbs

Table 6-2: Semiconductor Torque Requirements

6.09 Main Control Board

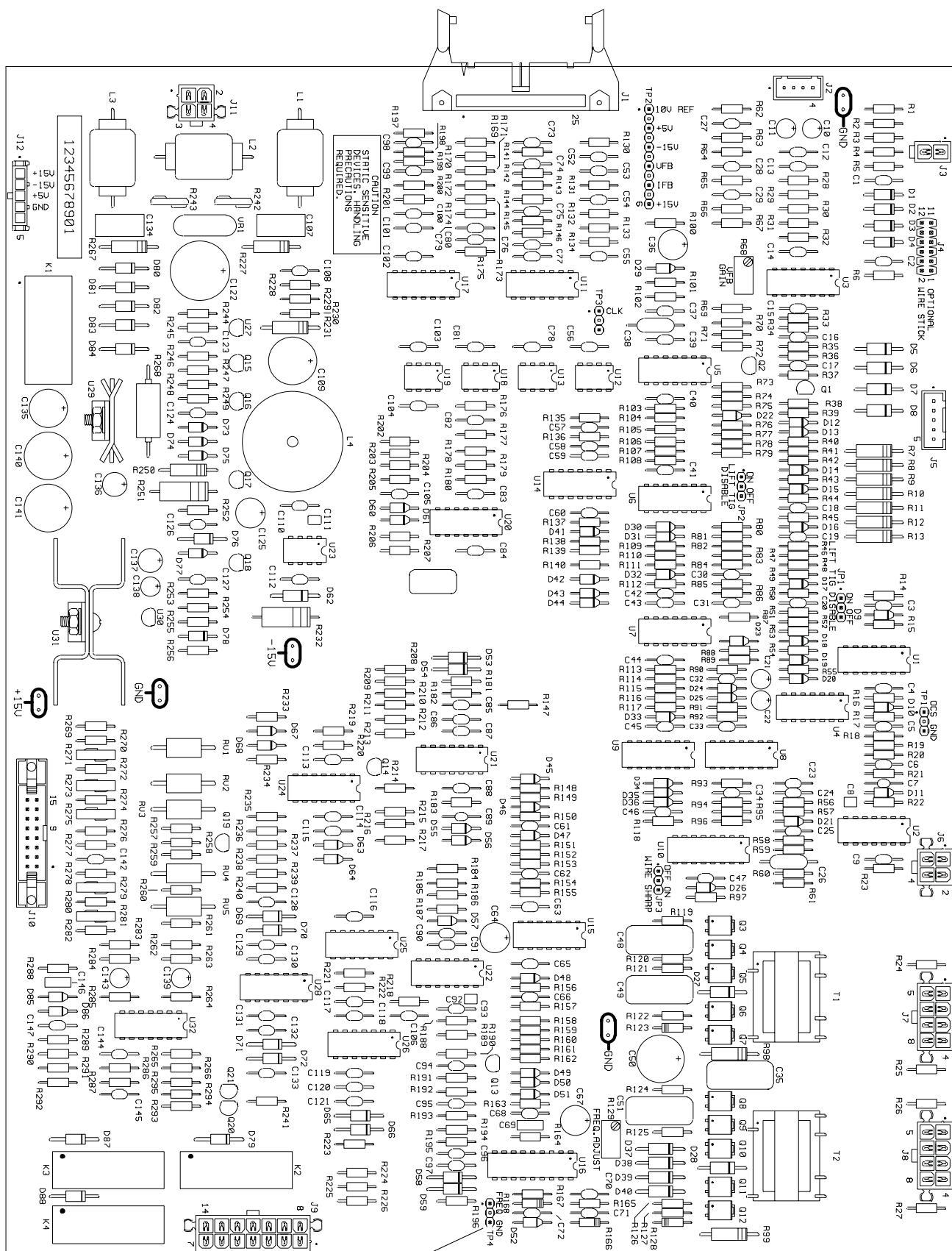


Figure 6-4: Main Control Board

6.10 Control Circuit Tests

Most of the control circuit measurements can be made on the main control board. (See Figure 6-5)

NOTE

Unless stated otherwise, use TP4-2 as the ground or common connection when making measurements on the control circuits.



DANGER:

The gate drive signals (T1, T2, R24-R27, J7 and J8, are all connected to the primary circuit, and are live whenever power is applied to the machine, even if the CONTROL POWER switch is in the OFF position. Switch off power at main disconnect before unplugging J7 and J8.

NOTE

Disconnect connectors J7, J8 and J9 from the control board before making the following checks. This will keep the input contactors off and keep from firing the gates on the IGBTs.

Connect primary power to the machine and turn the CONTROL POWER switch ON to power up the control circuit.

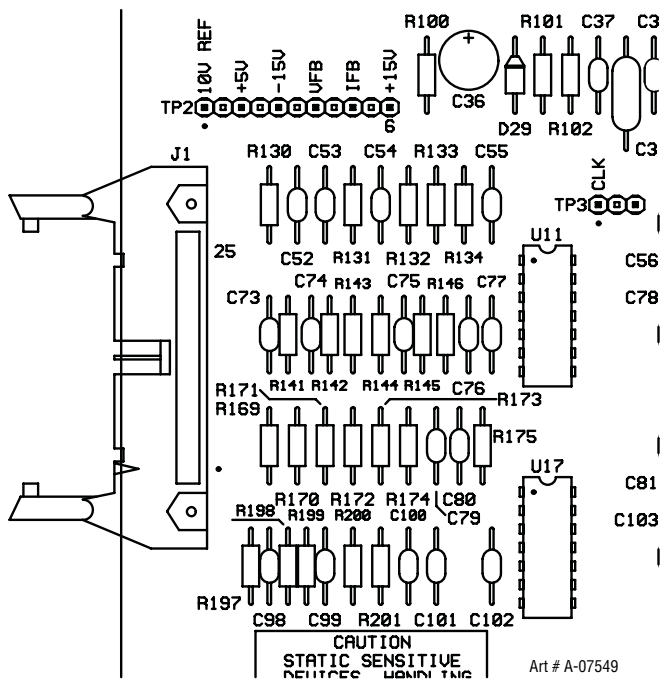
1. Power Supplies:

TP2-6 to TP4-2 (GND): +15 VDC

TP2-3 to TP4-2 (GND): -15 VDC

TP2-2 to TP4-2 (GND): +5 VDC

If the power supplies do not check ok, then disconnect the ribbon cable from J1 to isolate the main control board from the front panel board/s.



If the power supplies still do not check ok, verify that the proper AC voltage is coming up to the board.

L1 to TP4-2 (GND): 21 VAC

L3 to TP4-2 (GND): 21 VAC

L1 to L3: 42 VAC

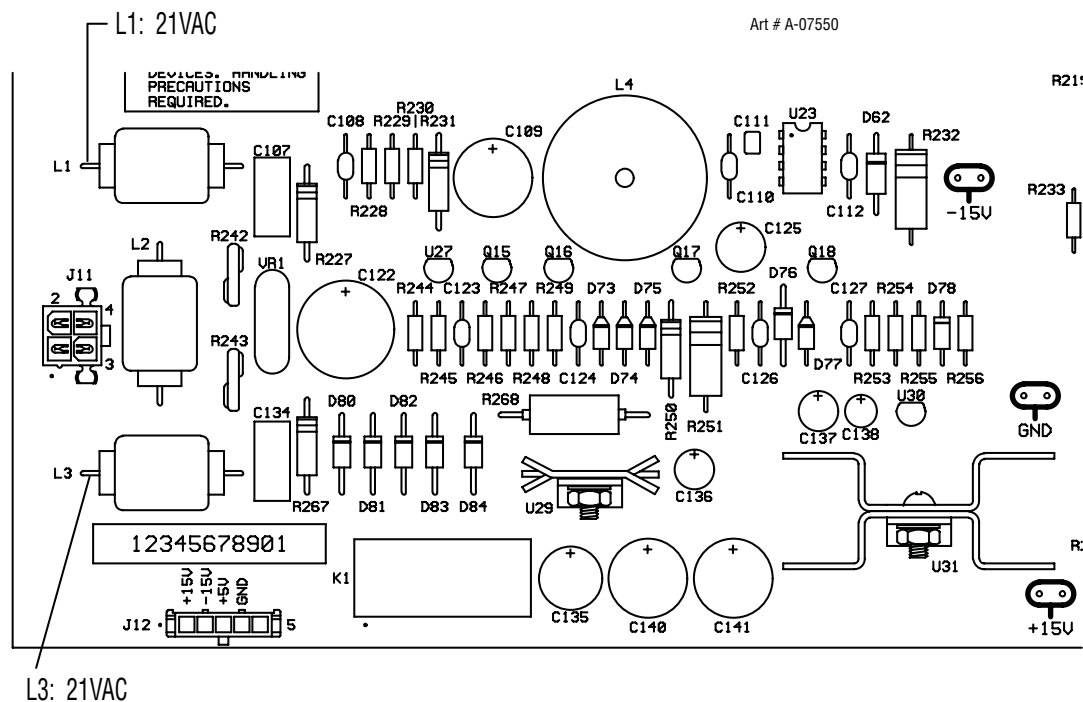


Figure 6-6: AC Power Check

POWERMASTER 500, 500P, 350, 350P

2. Reference Circuit

Set front panel to LOCAL (Remote off) control and mode to GMAW.

Measure 10V_Ref. as main A/V control pot on front panel is varied min to max.

A. TP2-1 to TP4-2: 2.27 to 10.0 VDCVolts display on front panel reads 10 to 44 Volts.

B. For GTAW, SMAW modes:

TP2-1 to TP4-2: 0.1 to 10.0 VDC
Amps display on front panel reads 4 to 560 Amps.

C. For PULSE GMAW mode:

TP2-1 to TP4-2: 0.1 to 10.0 VDC
Volts Display on front panel reads 4 to 440.

If TP2-1 reads OK but front panel display is wrong then the problem is with the front panel board or ribbon cable inter-connect.

If TP2-1 is not OK, then make the following checks:
(See Figure 6-7 below)

- R195 top side: +10V all the time with or without J1 plugged in.
- Min. ref RV2 bottom side: 0.07 VDC for SMAW, GTAW, or PULSE, 2.22 VDC for GMAW or with J1 unplugged.
- Ref. in to main control board at R222 top side: 0.07 to 10 VDC for GTAW min to max, 2.22 - 10 VDC min to max for GMAW. This is the reference input from the front panel.

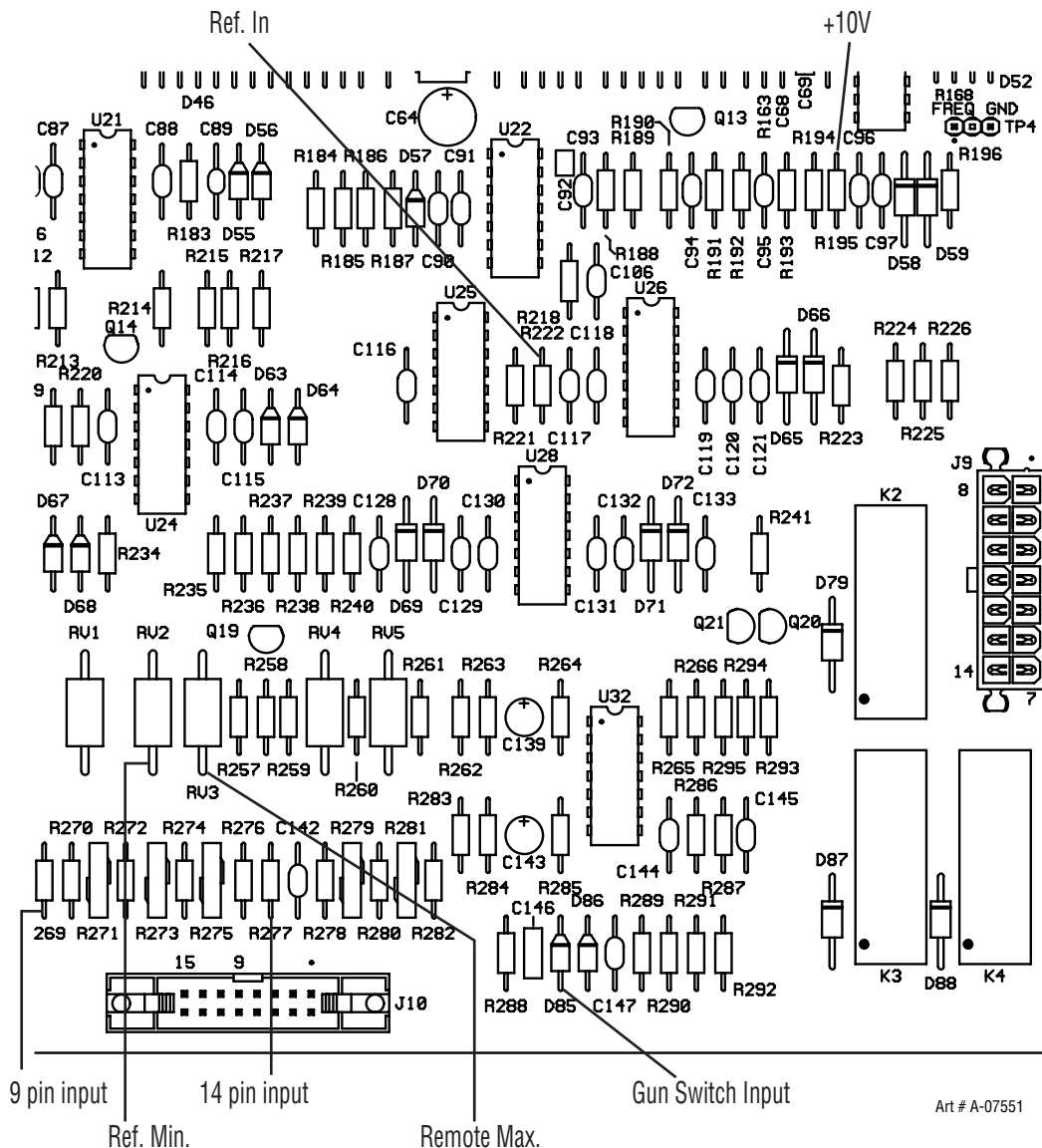


Figure 6-7: Reference Circuit

3. Gun Switch Circuit

This is the gun switch from the 19/14 pin remote receptacle. To activate gun switch short Pins A & B on 19 pin remote.

- A. Gun switch input: D85-Anode +15VDC for gun switch on, 0V for gun switch off. (See Figure 6-7)
- B. Gun switch output R131: +15VDC for gun switch on, 0V for gun switch off. (See Figure 6-8)

If gun switch input is not present to main control board that most likely indicates a problem with either the amphenol board or the J10 ribbon cable.

If the gun switch input is present but the gun switch output is not correct, then the problem is with the main control board. (Note: J1 must be plugged in for this circuit to work)

4. Output Contactor circuit:

The contactor signal comes from the front panel board to the main control board. It is based on the gun switch output signal. This is the signal which actually turns the inverter on and off.

- A. With gun switch on (jumper A-B on 19 pin remote), R175 is 13.6 VDC, with gun switch off, R175 is 0VDC. (See Figure 6-8)
- B. Output contactor switch on front panel should give the same results.
- C. With R175 at 13.6 VDC, D10-Cathode should also be high (+15VDC), with R175 at 0, D10-Cathode should also be low. (See Figure 6-10)
- D. With R175 at +13.6VDC, D10-Anode should be around 12VDC, with R175 at 0, D10-Anode should be 0.7. D10-Anode is the ON/OFF control signal to the PWM controller chip.
- E. If D10-Cathode is right but the Anode side is not, then check J5-4 to J5-5 jumper to make sure it is in place, and also make sure power supplies are ok. Also make sure the thermostat light is not on. Any one of these conditions can inhibit the inverter circuit from running by keeping D10-Anode low.

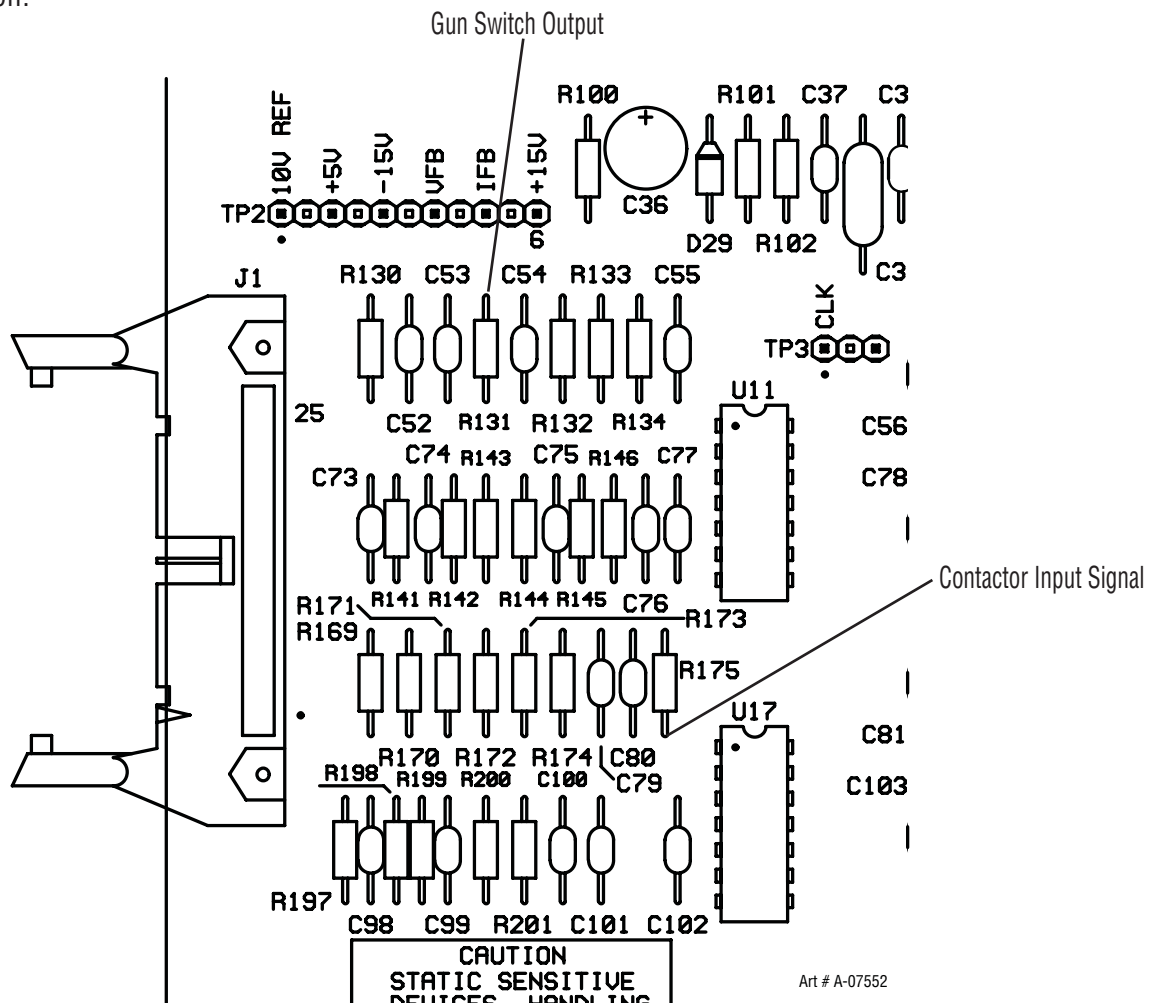


Figure 6-8

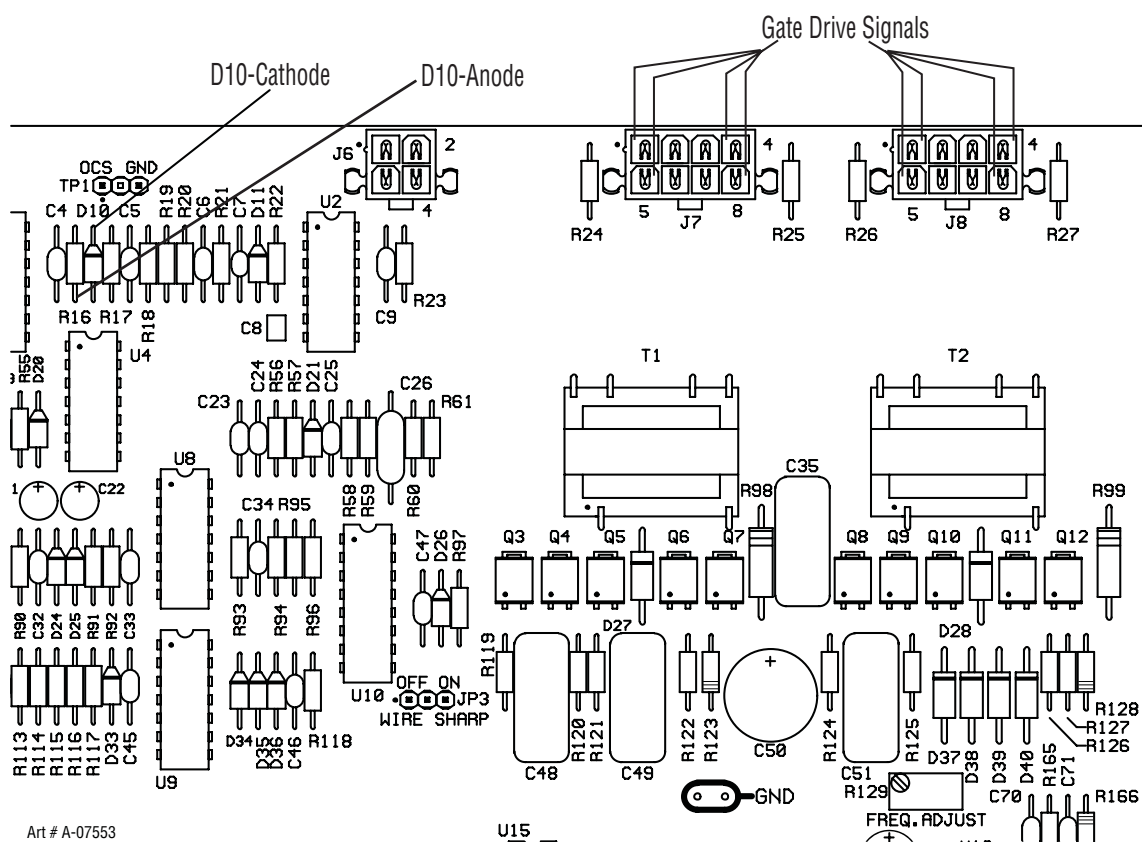
POWERMASTER 500, 500P, 350, 350P

5. Gate Signal Checks:

Note:

Remove jumper from pins A & B of 19 pin amphenol if it is still in place.

- Set machine for SMAW, LOCAL, preset A/V for 100 amps.
- Check gate drive voltages using digital meter set for AC volts.
- Use the CONTACTOR switch on the front panel to activate the gate drive. With CONTACTOR on the gate voltage should be approximately 14.5 VAC (at 17KHz), with the CONTACTOR off, the gate voltage should read 0 volts.
- Measure all four gate drive signals, J7-1 to J7-5, J7-4 to J7-8, J8-1 to J8-5 and J8-4 to J8-8.



6. Remote Control Checks:

- Jumper pins H and J together at 19 pin remote receptacle on rear panel.
- Select GMAW mode, and REMOTE on front panel.
- TP2-1 10V Ref should measure +10VDC all the time.
- Switch to GTAW mode.
- TP2-1 should vary from 0.1 to 10 VDC as the front panel A/V control is varied from min. to max.
- Remove jumper from pins H and J of 19 pin remote and jumper pin C to E on 14 pin remote receptacle on the rear panel.
- In GTAW mode, TP2-1 should vary from 0.2 to 10 VDC as the front panel control is varied from min. to max.
- In GMAW mode, TP2-1 should read 10 VDC all the time.

If either of these are not correct, then verify that the main board is providing the correct voltage at RV3 (see Figure 6-7) for remote max. This voltage should be 10VDC all the time for GMAW mode, and should vary from 0.1 to 10VDC for GTAW mode as the front panel control is varied from min. to max.

If RV3 is ok, then verify that the remote signal is making it to the main board from the amphenol board. The input from the 19 pin remote is at R269, and the input from the 14 pin remote is at R276. (See Figure 6-7)

7. Mode Checks:

The following checks can be done to verify that the correct signals are coming from the front panel board to the main control board. If a signal is not correct it most likely indicates a problem with either the front panel board or the ribbon cable inter-connect.

For the following, if the mode is selected the signal should read around 1 Volt if it is not selected it should read around 14 Volts.

- GTAW mode, check at R133 (See Figure 6-10).
- SMAW mode, check at R145 (See Figure 6-10).
- GMAW mode, check at R198 (See Figure 6-10).
- CAG/PULSE mode, check at R200 (See Figure 6-10)
- Check REMOTE/LOCAL mode at R173 (See Figure 6-10). LOCAL = 14 Volts, REMOTE = 1 Volt.

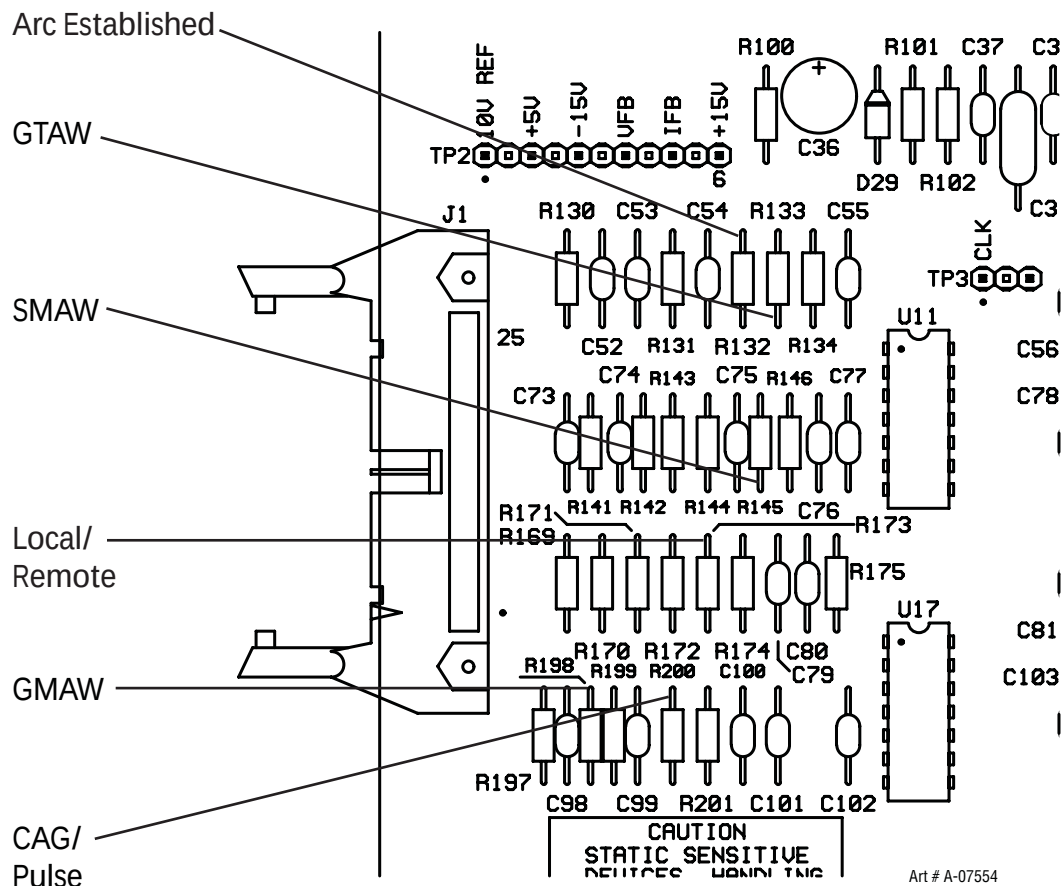


Figure 6-10

POWERMASTER 500, 500P, 350, 350P

8. Relay Checks:

K2 controls the main contactor. K3 controls the precharge inrush contactor, and K4 controls the fans.

- A. Measure the continuity at J9 when power is first applied to the board.
- B. J9-3 to J9-5 checks shorted when power is first applied to the board, open after approximately 7 seconds. This drives the inrush contactor.

- C. J9-1 to J9-5 checks open when power is first applied, checks shorted after approximately 4 seconds. This drives the main contactor.
- D. J9-7 to J9-5 checks open before power is applied to the board, checks shorted as soon as power is applied. This drives the fans.

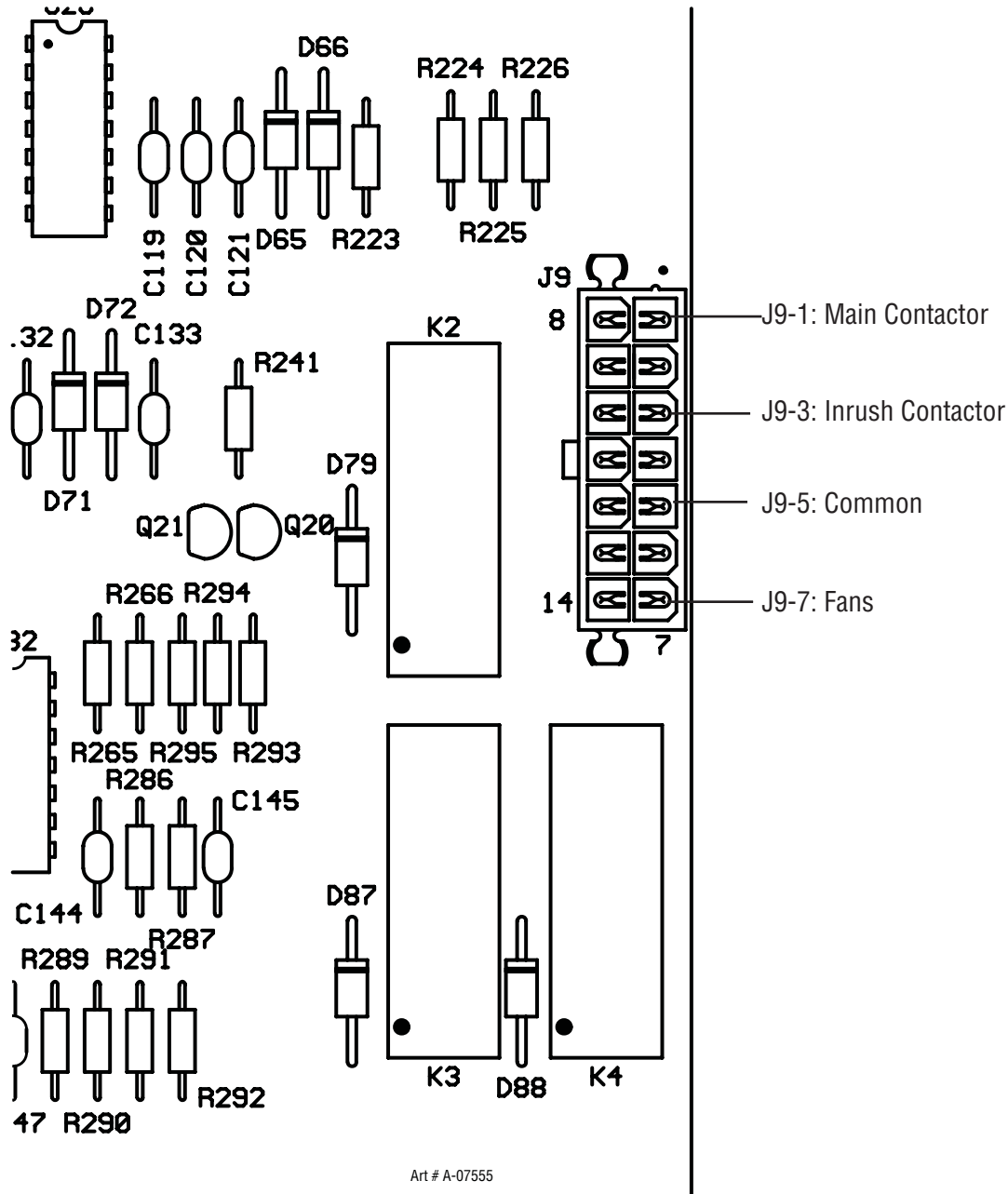


Figure 6-11

9. Current Feedback Ifb:

Verification of the Ifb signal requires putting a load on the machine. Make sure that all connectors are plugged into the board.

Note:

The following test is intended as a simple verification that the circuit is functioning. To verify the calibration of the current and voltage feedback signals, see the calibration test later in this chapter.

- A. Connect to a load bank set for approximately 200 amps at 24 volts.
- B. Set machine for SMAW mode, set Arc Force to minimum. Set for LOCAL, and preset to 200 amps on front panel.
- C. With no load on the machine Ifb should read 0 volts.
- D. Energize the output of the machine using the front panel contactor switch.
- E. TP2-5 Ifb should read 2 Volts, and the amps display on the front panel should read approximately 200 amps.
- F. If TP2-5 is ok but the meter does not read actual amps correctly, then check the voltage feedback as well as the arc established signal.
- G. If TP2-5 is not correct then verify the functionality and connection of the current sensor device. It connects to J2 on the main control board.
- H. With the plug disconnected at the current sensor and power off of the machine, the sensor should show the following resistance;

Pin 1 to pin 4 > 1 meg

Pin 2 to pin 4 > 1 meg

Pin 3 to pin 4 approximately 22K

With the sensor plugged in and power applied the sensor should have the following voltages:

Pin 1 +15V supply

Pin 2 -15V supply

Pin 3 0 to 4 volts feedback signal

Pin 4 circuit common (same as TP4-2)

Note:

If the current sensor is unplugged from the board or the signal line is broken then the machine will not produce any output and Ifb will measure approximately 14 Volts all the time.

10. Voltage Feedback Vfb:

Verification of the Vfb signal requires putting a load on the machine. Make sure that all connectors are plugged into the board.

Note:

The following test is intended as a simple verification that the circuit is functioning. To verify the calibration of the current and voltage feedback signals, see the calibration test later in this chapter.

- A. Connect to a load bank set for approximately 200 amps at 24 volts.
- B. Set machine for GMAW mode, Set to Local control and preset the output to 24.0 volts.
- C. With no load on the machine Vfb should read 0 volts.
- D. Energize the output using the GUN SWITCH input (jumper A-B on the 19 pin amphenol receptacle on the rear panel). The gun switch must be used instead of the front panel contactor switch or the voltage will not read correct.
- E. TP2-4 should read 2.4 Volts, and the front panel volts display should read approximately 24 volts.
- F. If TP2-4 is ok but the front panel display is wrong then verify both current feedback and arc established signals.
- G. If TP2-4 is not correct then verify that the output terminal voltage is coming up to the main control board at J3-1 (plus) to J3-2 (minus)

11. Arc established circuit:

Measure the arc established signal at R132 (See Figure 6-11).

- A. With no load on the machine, arc established should read 0 volts.
- B. With any load greater than approximately 4 amps and 4 volts, arc established should read approximately 14 volts.

Note:

Arc established should also be present on pin M of the 19 pin remote receptacle on the rear panel.

6.11 Calibration Procedure

Voltage and current feedback calibration procedure:

The following procedure can be used to check the calibration of the Power-Master.

A resistive load bank set for approximately 100Amps/24 Volts is required. A resistive external shunt and digital meter set to read average DC millivolts is required to check the current. A digital meter set to read average DC volts is required to read the machine output voltage.

- A. Set the Power-Master to SMAW, LOCAL, and arc force set to minimum.
- B. Preset the output amperage to 100.
- C. Energize the output using the gun switch input (jumper A-B on the 19 pin remote).
- D. Verify the amperage reading on the Power-Master is 100 ± 4 amps.
- E. Adjust the output amperage control of the Power-Master 500 until the amperage display reads exactly 100.
- F. Verify the actual load amps using the external shunt. Load amps should be 100 ± 4 amps. There is no calibration adjustment, if the calibration is off then either the current sensor or the control board is out of calibration. At 100 amps of load current the current sensor output should be 0.80 Volts dc.
- G. De-energize the output by removing the gun switch signal.
- H. Set the machine to GMAW mode.
- I. Preset the output to 24.0 Volts.
- J. Energize the output using the gun switch input. The contactor switch on the front panel can not be used or the voltage readings will be off.
- K. Verify the voltage reading on the front panel display is 24.0 ± 0.2 volts.
- L. Adjust the output voltage control on the front panel of the Power-Master until the voltage display reads exactly 24.0 volts.
- M. Verify the output terminal volts directly on the copper bus bar of the output terminal using the external digital meter reading average volts. Voltage should be 24.0 ± 0.5 Volts.
- N. If the voltage is out of calibration, it can be adjusted with R68 on the main control board.

SECTION 7: REPAIR PROCEDURES

7.01 Output Diode Replacement:

The following procedure should be used for replacing a failed output diode module.

Step 1: Remove the two nuts securing the transformer bus bars to the diode bus bars.

Step 2: Loosen the bolts on the other end of the two transformer bus bars. These bolts do not need to be removed. Pivot the two transformer bus bars to the side out of the way.

Step 3: Remove the six bolts holding the diode bus bars to the diodes. Let the bus bars hang free on the snubber wires. It is not necessary to remove the wires.

Step 4: Identify the failed diode module/s.

Step 5: Remove the three mounting screws holding the diode to the heatsink.

Step 6: Clean the heatsink area where the diode mounts.

Step 7: Apply a thin layer of thermal compound to the back of the diode.

Step 8: Mount diode on heatsink and hand tighten mounting screws. **DO NOT TORQUE YET.**

Step 9: Attach bus bars to diodes and hand tighten.

Step 10: Torque the diode mounting screws. (See Figure 7-1). Torque the center mounting screw first, and then the two outer screws.

Step 11: Torque the six screws holding the bus bars to the diodes (See Figure 7-1).

Step 12: Reconnect the transformer bus bars.

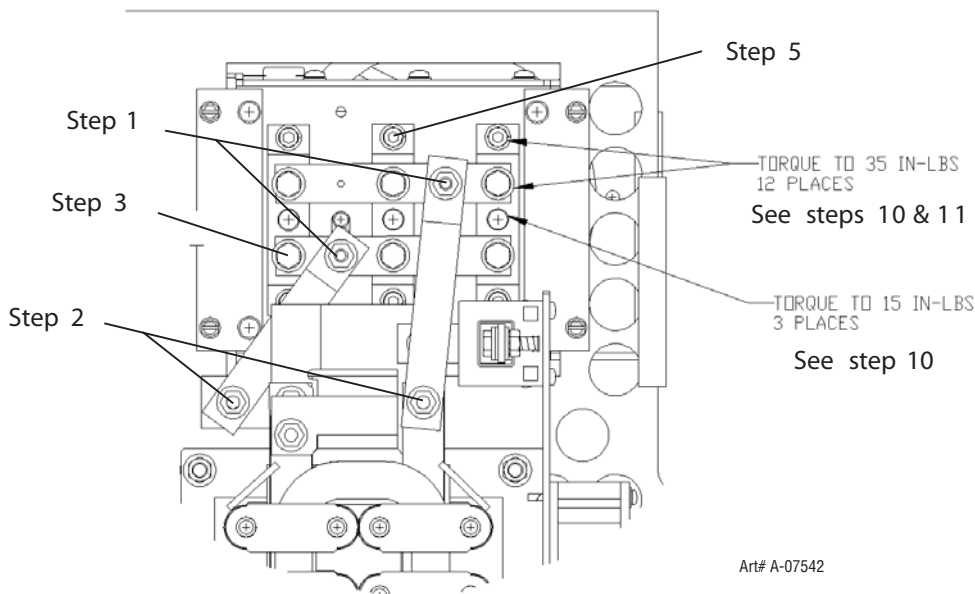


Figure 7-1: Output Diode Assembly

7.02 IGBT Module Replacement:

The following procedure can be used to replace one of the IGBT modules. The IGBT can be replaced without removing the capacitor boards, if the capacitor boards are still ok.

Step 1: Remove the screws holding the transformer leads to the IGBT modules. Remove the transformer leads from both modules so they can be positioned out of the way.

Step 2: Remove the thermostat so it can be positioned out of the way.

Step 3: Disconnect the gate drive connector from the IGBT module being replaced.

Step 4: Remove the four mounting screws holding the IGBT to the heatsink.

Step 5: Remove the two screws connecting the capacitor boards to the IGBT. Remove the brass spacer from underneath the capacitor board lead.

Step 6: Slide the IGBT up or down to clear the bus bars on the capacitor boards, and remove the IGBT.

Step 7: Clean the area of the heatsink where the IGBT mounts. This area must be free of contaminations which would prevent the IGBT from mounting flush to the heatsink.

Step 8: Apply a thin layer of thermal compound to the back of the new IGBT module.

Step 9: Slide the new IGBT back in place.

Step 10: Reassemble in reverse order of removal. **TORQUE MOUNTING SCREWS TO 35 IN-LBS, AND TERMINAL SCREWS TO 27 IN-LBS.**

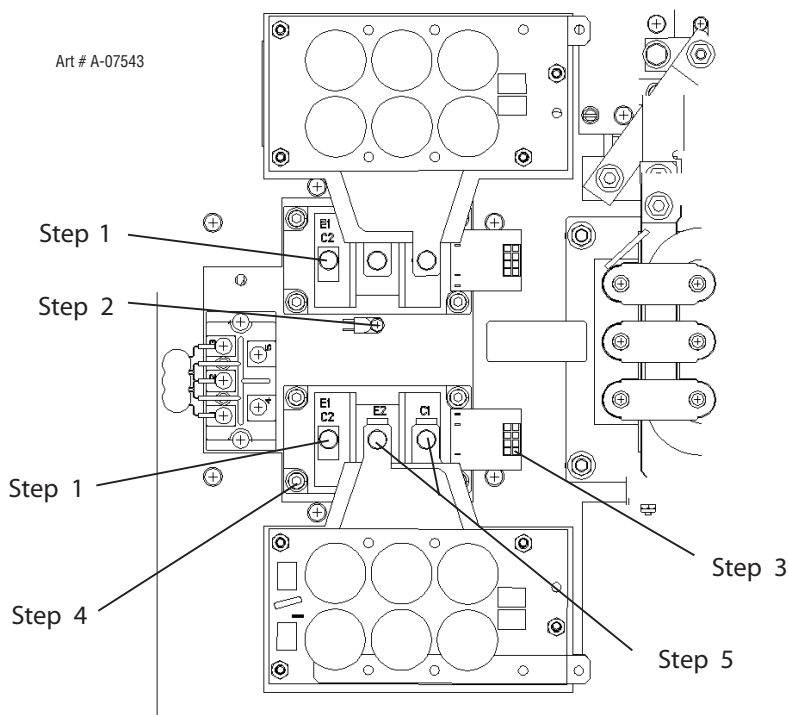


Figure 7-2: IGBT Replacement

SECTION 8: PARTS LIST

8.01 Equipment Identification

All identification numbers as described in the Introduction chapter must be furnished when ordering parts or making inquiries. This information is usually found on the nameplate attached to the equipment. Be sure to include any dash numbers following the Specification or Assembly numbers.

8.02 How To Use This Parts List

The Parts List is a combination of an illustration and a corresponding list of parts which contains a breakdown of the equipment into assemblies, subassemblies, and detail parts. All parts of the equipment are listed except for commercially available hardware, bulk items such as wire, cable, sleeving, tubing, etc., and permanently attached items which are soldered, riveted, or welded to other parts. The part descriptions may be indented to show part relationships.

To determine the part number, description, quantity, or application of an item, simply locate the item in question from the illustration and refer to that item number in the corresponding Parts List.

POWER SUPPLY NUMBERS:

Power-Master 500	100085
Power-Master 500P	100086
Power-Master 350	100078
Power-Master 350P	100079

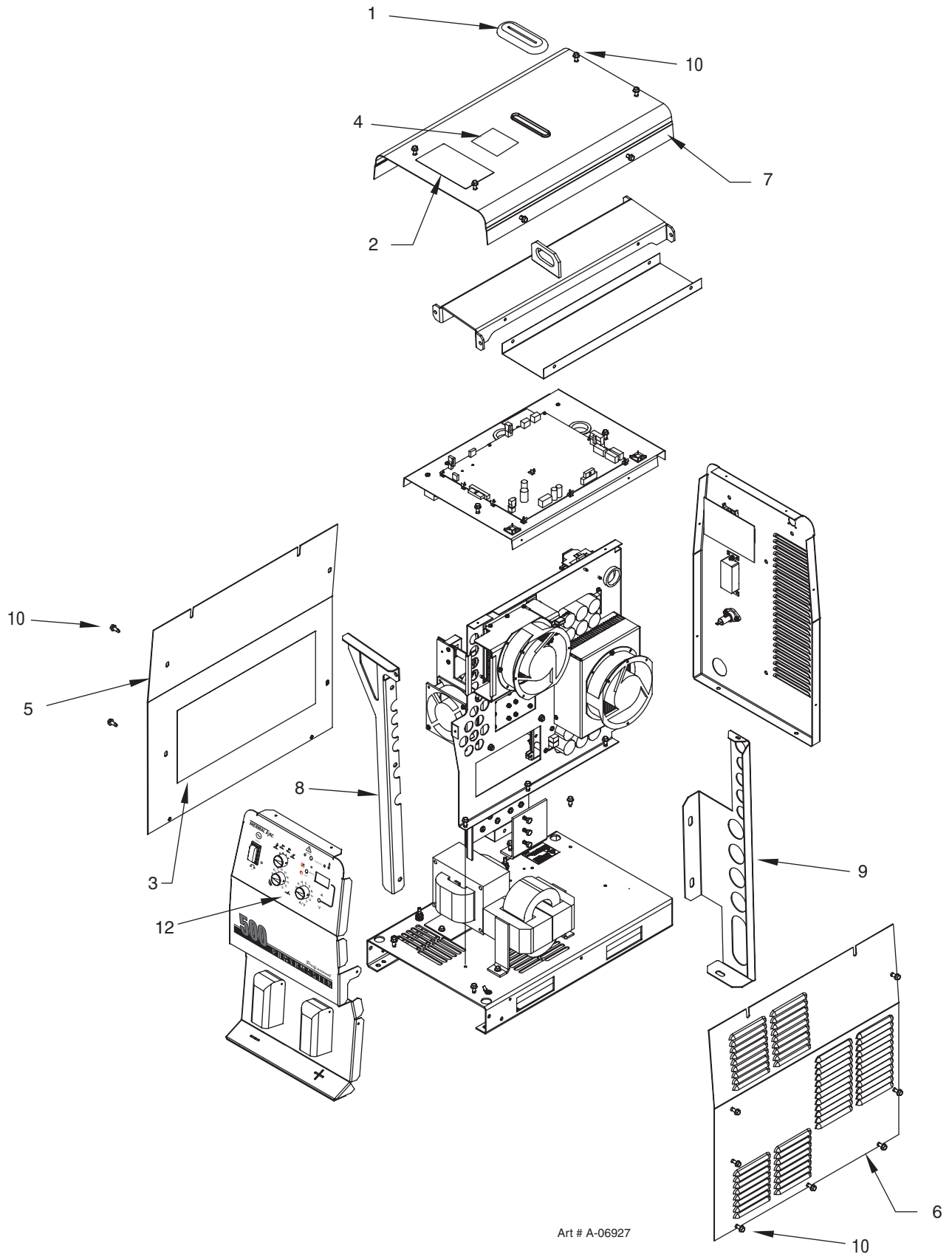
POWERMASTER 500, 500P, 350, 350P

8.03 External Panels

Item	Qty	Description	Part Number
1	1	Bushing, Lifting Eye, PM, IPS	12CW2170
2	1	Label, Precaution, Arc Equip	204036
3	1	Label, Volt Changeover, PM, IPS	830963
4	1	Label, Warning, Lifting, PM, IPS	831132
5	1	Panel, Left Side, PM, IPS	831131PKD
6	1	Panel, Right Side, PM, IPS	831130PKD
7	1	Panel, Top, PM, IPS	831118CLAPKD
8	1	Chassis Support, Front, PM, IPS	831111BLKPKD
9	1	Chassis Support, Side, PM, IPS	831122BLKPKD
10	35	Screw, Hex HD, M5-1.4x13, STZC	See Note 1
11	2	Pin, Roll 1/8" x 2", PM, IPS	831125PKD
12	1	Overlay, Front Controls PM500	831073PKD
12	1	Overlay, Front Controls PM350	831138PKD
12	1	Overlay, Front Controls, PM500P	831098PKD
13	4	Washer, Insulation, Flat, PM, IPS	5CW976A

Note 1:

This part is available at most hardware stores.



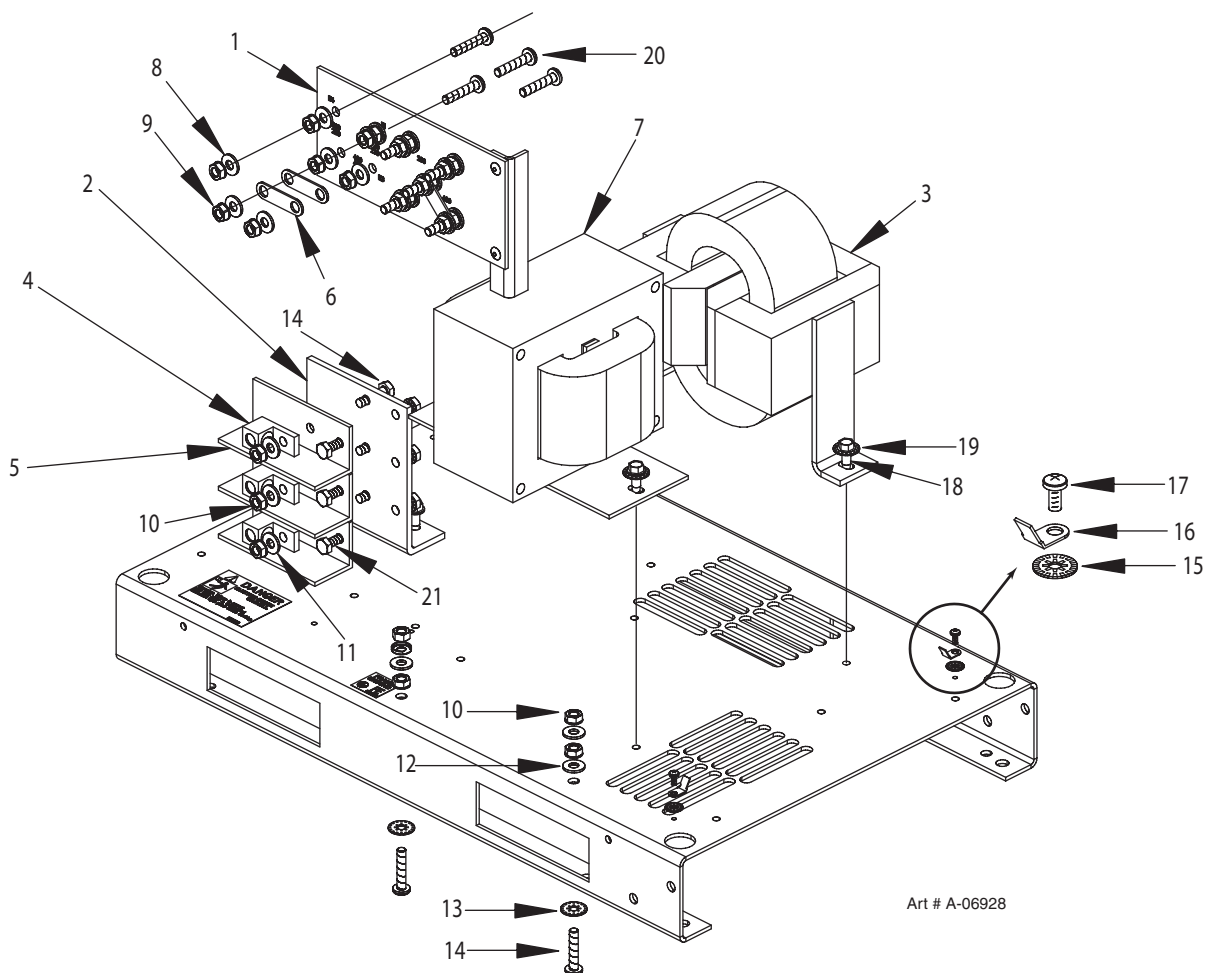
POWERMASTER 500, 500P, 350, 350P

8.04 Base Parts

Item	Qty.	Description	Part Number
1	1	Board,Volt Selection, PM, IPS	830941
2	1	Bracket,Input Line, PM, IPS	830966
3	1	Reactor,Assy,560A, PM, IPS	830942
4	3	Connector,2/0-14Block, PM, IPS	830968
5	3	Insulation,Input Line, PM, IPS	830967
6	3	Strap, 220/440 Volts, PM, IPS	CW811
7	1	Transformer,Control, PM, IPS	830928
8	20	Washer,6.4mm,Flat	See Note 1
9	14	Nut, Hex, 1/4"-20, Keps	See Note 1
10	13	Nut, Hex, M6-1,STZP	See Note 1
11	13	Washer,6.4mm,Int Lock	See Note 1
12	4	Washer,6.4mm IDx19mm OD,Flat	See Note 1
13	4	Washer,6.4mm,Ext Lock	See Note 1
14	5	Screw,Hex M6-1.0x30, STZP	See Note 1
15	2	Washer,5.4mm,Ext Lock	See Note 1
16	2	Terminal, QC, 1/4"	See Note 1
17	2	Screw,PHCR,#10-24x1/2"	See Note 1
18	4	Screw,Hex HD,M8-1.25x12, STZC	See Note 1
19	2	Washer,8.4mm,Ext Lock	See Note 1
20	6	Screw,Hex HD,1/4"-20x1.0"	See Note 1
21	3	Screw,Hex HD, M6-1.0x20, STZP	See Note 1

Note 1:

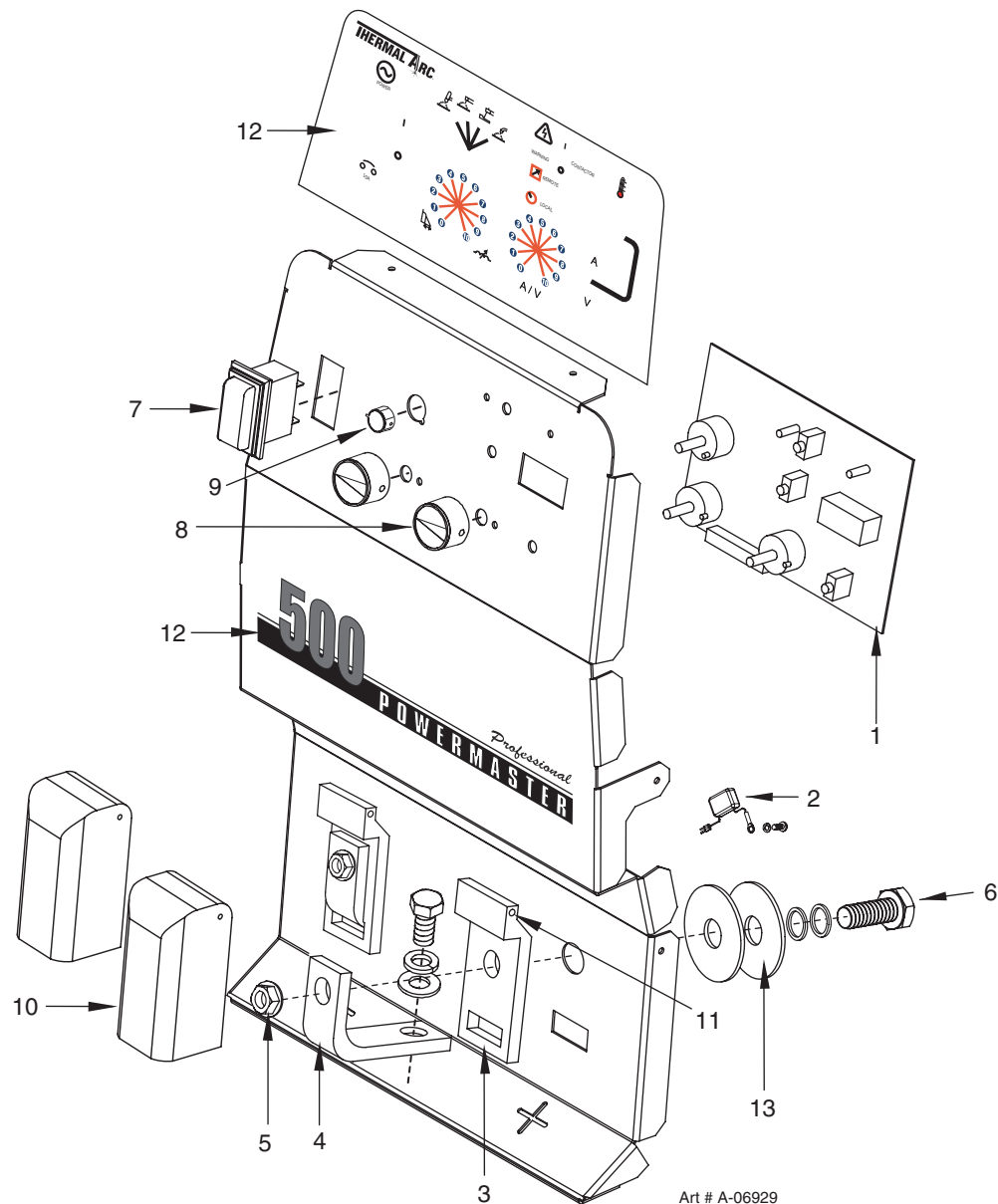
This part is available at most hardware stores.



Art # A-06928

8.05 Front Panel Parts (Power-Master 500 and 350)

Item	Qty.	Description	Part Number
1	1	PCB,Non-PulseDisplay, PM, IPS	830906
2	2	Capacitor, 47nF 630V, PM, IPS	707158PKD
3	2	Bushing, Insulator, PM, IPS	357654
4	2	Bus Stud Cable, PM, IPS	707665PKD
5	2	Nut, Hex, 1/2"-13	400614-001
6	2	Screw,Hex HD,1/2"-13x1.75"	351505
7	1	Circuit, Breaker, 10A, 2 Pole	830362
8	2	Knob,Control,1/4" IDx1.6"	870696PKD
9	1	Knob,Control,1/4" IDx.57"	870734
10	2	Cover, Terminal	357655
11	2	Pin, Roll 1/8" x 2", PM, IPS	831125PKD
12	1	Overlay,Front Controls PM500	831073PKD
12	1	Overlay,Front Controls PM350	831138PKD
13	4	Washer,Insulation,Flat,PM,IPS	5CW976A



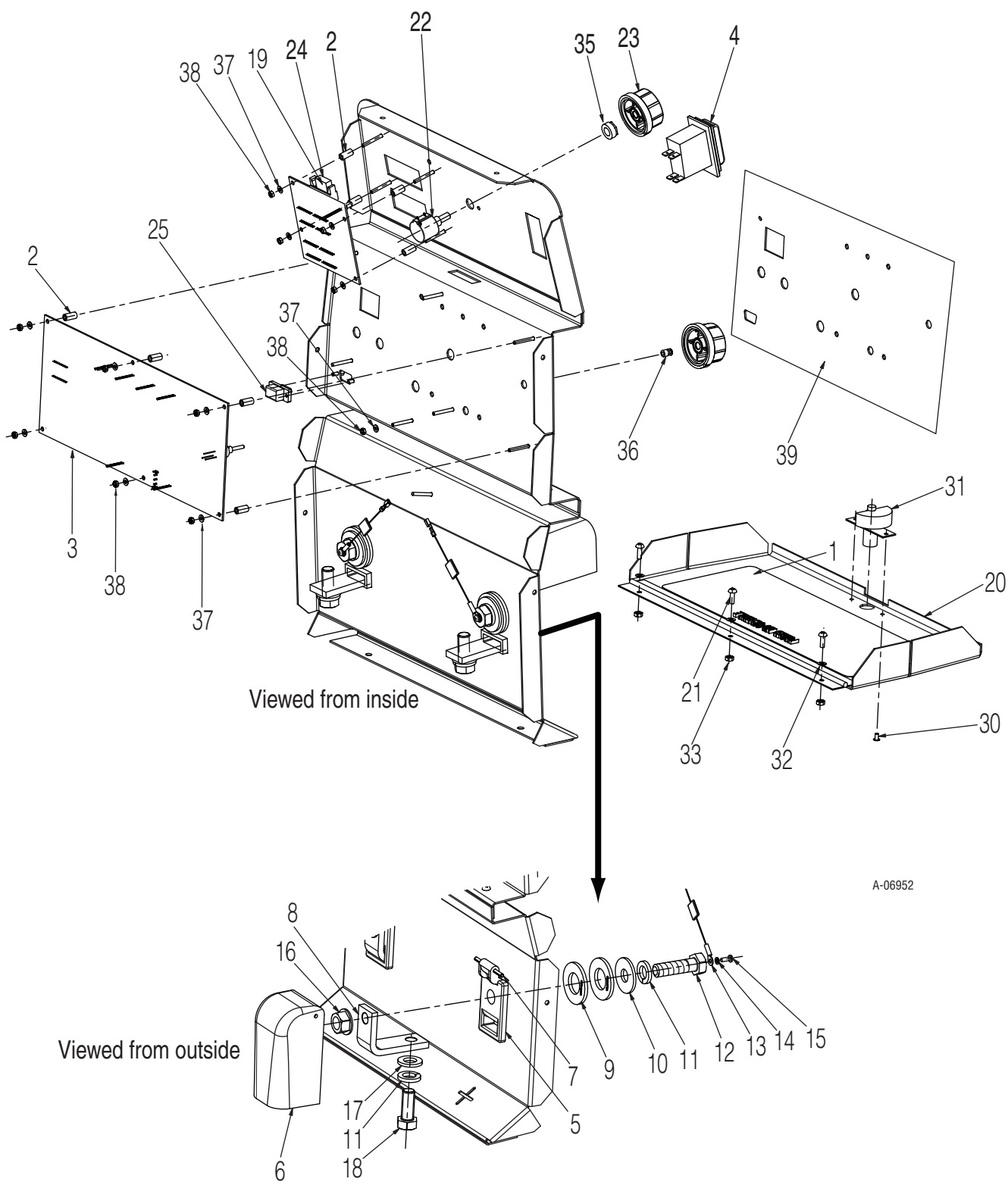
POWERMASTER 500, 500P, 350, 350P

8.06 Front Panel Parts (Power-Master 500P and 350P)

Item	Qty.	Description	Part Number
1	1	Overlay,Weld Schedule,PM500P	831114PKD
2	10	Spacer,.14IDx.5 Nylon, PM, IPS	204600-001
3	1	PCB, Pulse, PM500P, IPS	830831
4	4	Circuit, Breaker, 10A, 2 Pole	830362
5	2	Bushing, Insulator, PM, IPS	357654
6	2	Cover, Terminal	357655
7	2	Pin, Roll 1/8" x 2", PM, IPS	831125PKD
8	2	Bus Stud Cable, PM, IPS	707665PKD
9	4	Washer,Insulation,Flat,PM,IPS	5CW976A
10	2	Washer,13mm,Flat,STZP	See Note 1
11	4	Washer,13mm,Spring	See Note 1
12	2	Screw,Hex HD,1/2"-13x1.75"	351505
13	2	Capacitor, 47nF 630V, PM, IPS	707158PKD
14	2	Washer,3.5mm,Spring	See Note 1
15	2	Screw,PHCR,#6-32x3/8"	See Note 1
16	2	Nut, Hex, 1/2"-13	400614-001
17	2	Washer,13mm,Flat,STZP	See Note 1
18	2	Screw,Hex HD,M12-1.75x30,STZP	See Note 1
19	1	PCB, Display, PM, IPS	830838
20	1	Door Control Assy, PM, IPS	830903WBLKPKD
21	3	Screw,PHCR,M4x12mm,Blinding	See Note 1
22	1	Harness, Control Pot, PM, IPS	830935
23	2	Knob,Control,1/4" IDx1.6"	870696PKD
24	1	Cable,Ribbon,10P,6", PM, IPS	171370-005
25	1	Cable, D-SUN Assy, PM, IPS	830936
30	2	Rivet,1/8,BLIND STEEL	See Note 1
31	1	Latch,Self Adjusting, PM, IPS	830960
32	3	Washer,4.4mm,Int Lock	See Note 1
33	3	Nut, Hex M4X0.7, STZP	See Note 1
35	1	Nut, 3/8"-32, Lock, PM,IPS	402663
36	1	Reducer, Shaft Hole	404454
37	11	Washer,3.5mm,Ext Lock	See Note 1
38	11	Nut, Hex M3X0.5, STZP	See Note 1
39	1	Overlay,Pulse Control,PM500P	831103PKD

Note 1:

This part is available at most hardware stores.



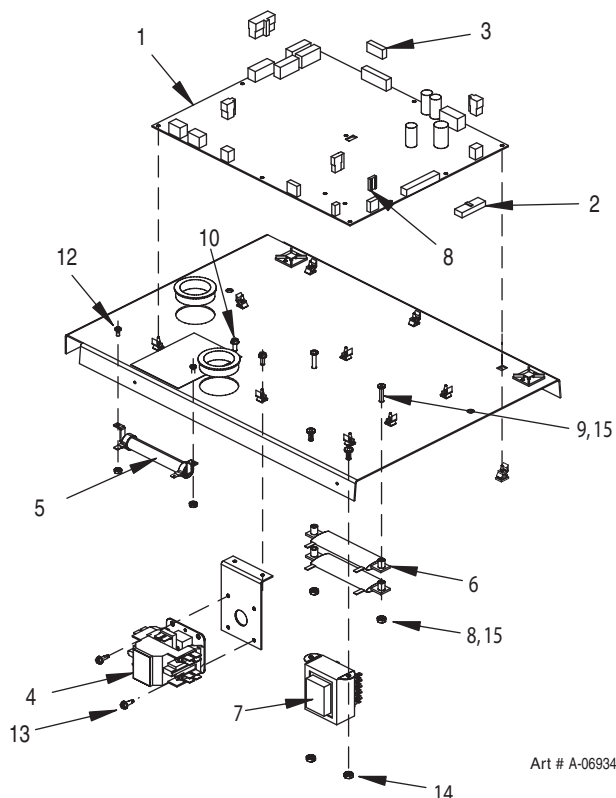
POWERMASTER 500, 500P, 350, 350P

8.07 PC Board Parts

Item	Qty.	Description	Part Number
1	1	PCB, Control, PM, IPS	830894
2	1	Cable,Ribbon,26 P,13", PM, IPS	204038-002
3	1	Cable,Ribbon,16P,20", PM, IPS	204038-012
4	1	Contactor,30A,2 Pole, PM, IPS	406240-002
5	1	Resistor,50 Ohm,50w,QC,PM,IPS	830394
6	2	Resistor,10 Ohm,55W, PM, IPS	830345
7	1	Transformer, Control, PM, IPS	830336
8	4	Rivet,4mmx6.4,BLIND STEEL	See Note 1
9	2	Screw,PHCR,M4-.7x30mm,STZP	See Note 1
10	4	Rivet,4mmx6.4,BLIND STEEL	See Note 1
11	2	Nut, Hex, M4x.7, STZP	See Note 1
12	2	Rivet,4mmx6.4,BLIND STEEL	See Note 1
13	2	Screw,Hex HD,M5-1.4x13, STZC	See Note 1
14	2	Nut, Hex, M4x.7, STZP	See Note 1
15	4	Washer,4.4mm,Int Lock	See Note 1

Note 1:

This part is available at most hardware stores.

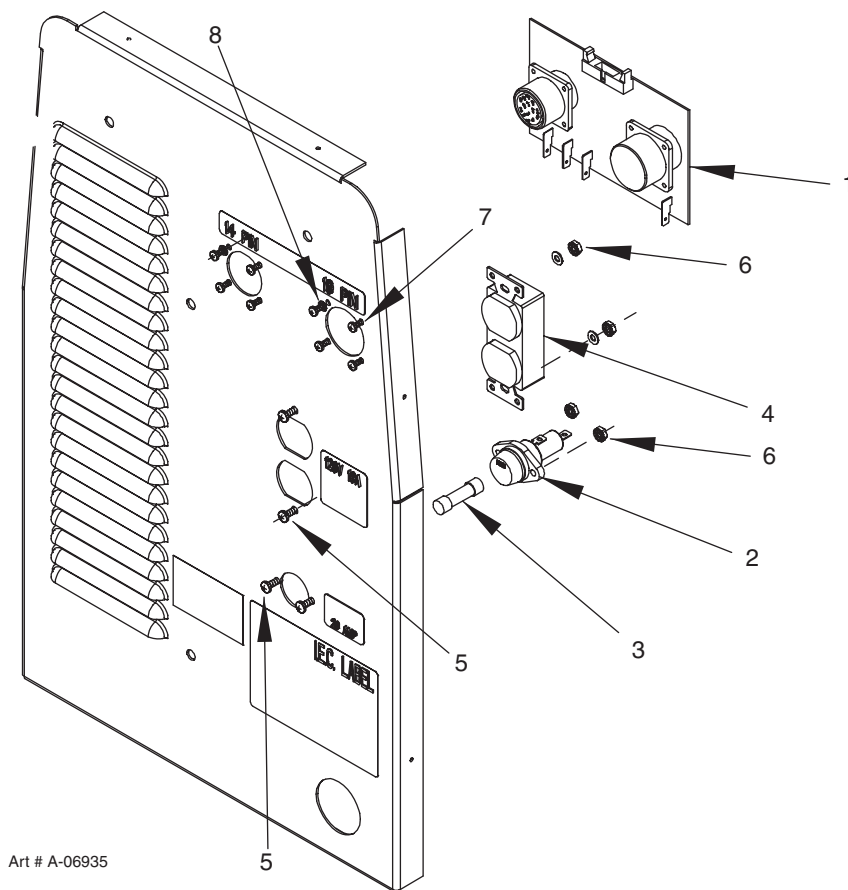


8.08 Rear Panel Parts (Power-Master 500 and 350)

Item	Qty.	Description	Part Number
1	1	PCB, Amphenol, PM, IPS	830427
2	1	Fuse Holder, PM, IPS	402151
3	1	Fuse, 20A, 600V, Bussman KTK	405093-002
4	1	Receptacle, 120V, 10A, PM, IPS	402670
5	4	Screw, PHCR, M4-.7x16mm, STZP	See Note 1
6	4	Nut, Hex, M4x.7, STZP	See Note 1
7	8	Screw, PHCR, #6x3/8", self tap	See Note 1
8	2	Washer, 3.5mm, Int Lock	See Note 1

Note 1:

This part is available at most hardware stores.



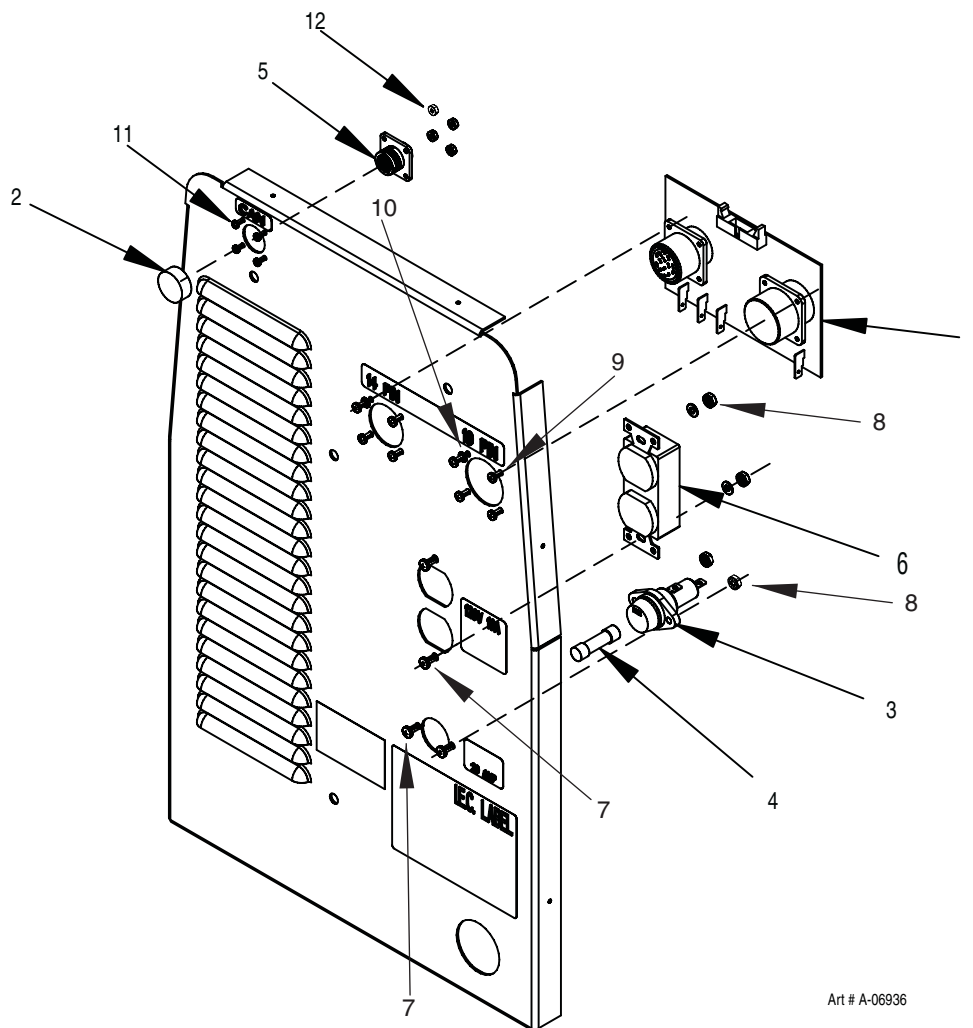
POWERMASTER 500, 500P, 350, 350P

8.09 Rear Panel Parts (Power-Master 500P and 350P)

Item	Qty.	Description	Part Number
1	1	PCB, Amphenol, PM, IPS	830427
2	1	Cap,Can Port, PM, IPS	830961
3	1	Fuse Holder, PM, IPS	402151
4	1	Fuse,20A,600V,Bussman KTK	405093-002
5	1	Harness, Can Assembly, PM, IPS	830937
6	1	Receptacle,120V,10A, PM, IPS	402670
7	4	Screw,PHCR,M4-.7x16mm,STZP	See Note 1
8	4	Nut, Hex, M4x.7, STZP	See Note 1
9	8	Screw,PHCR,#6x3/8",self tap	See Note 1
10	2	Washer,3.5mm,Int Lock	See Note 1
11	4	Screw,PHCR,M3-0.5x10mm,STZP	See Note 1
12	4	Nut, Hex, M3x.5, STZP	See Note 1

Note 1:

This part is available at most hardware stores.



Art # A-06936

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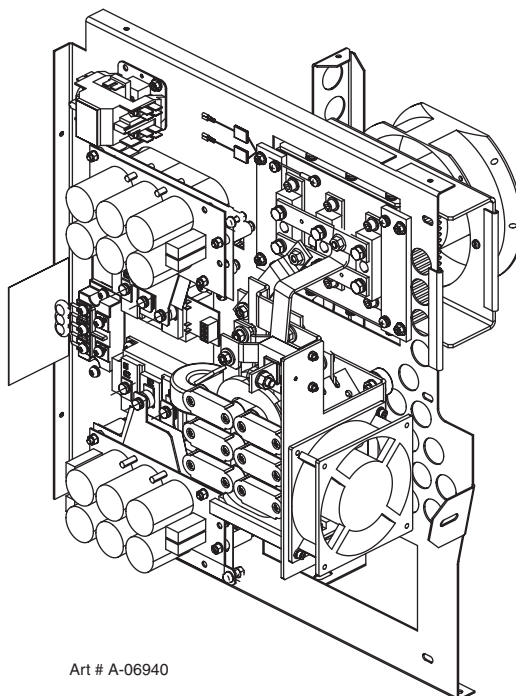
POWERMASTER 500, 500P, 350, 350P

8.10 Center Chassis Parts

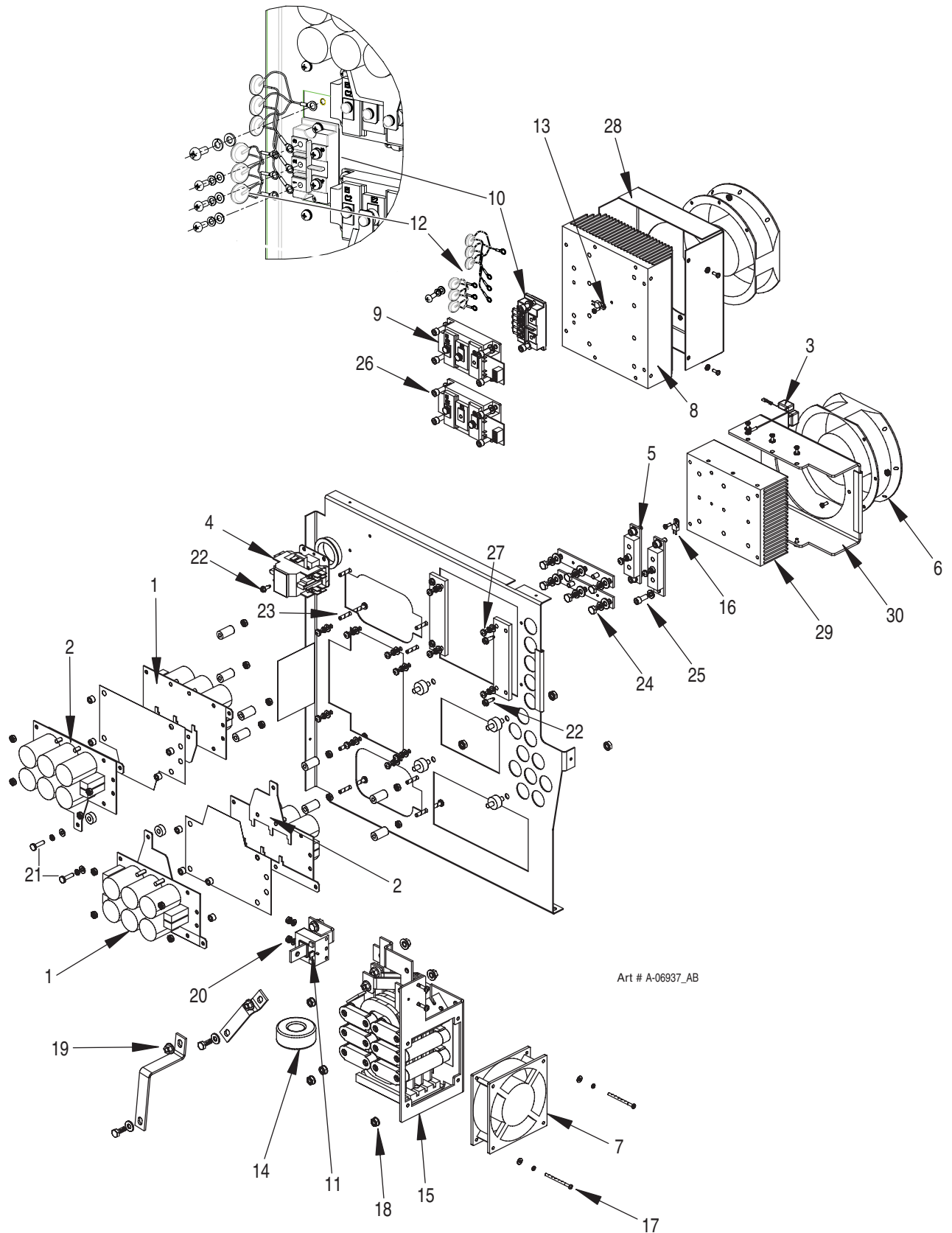
Item	Qty.	Description	Part Number
1	2	PCB,Capacitor,Neg,"B", PM, IPS	830413
2	2	PCB,Capacitor,Pos,"B", PM, IPS	830414
3	1	Capacitor,Snubber,2x47nF,IPS	707159PKD
4	1	Contact,40A,2 Pole, PM, IPS	406241-002
5	2	Diode,Dual,320A,400V, PM, IPS	830358
6	2	Fan, Cooling, 6", PM, IPS	830353
7	1	Fan, Transformer,4", PM, IPS	830360
8	1	Heatsink,IGBT, PM, IPS	707107
9	2	IGBT Module Assembly, PM, IPS	830962
10	1	Rectifier,1600V,100A, PM, IPS	830911
11	1	Sensor, Current, 500A, PM, IPS	205018-001
12	1	KIT Suppressor MOV Assy PM500	707618-9PKD
13	1	Thermostat Assy,85°C, PM, IPS	830934
14	1	Transformer, Current, PM, IPS	830351
15	1	Transformer, Inverter, PM, IPS	830912
16	1	Thermostat Assy,85°C, PM, IPS	831194
17	2	Screw, PHCR, M4-.7x50,STZC	See Note 1
18	8	Nut, Hex, 1/4"-20, Keps	See Note 1
19	2	Nut,Hex,1/4"-20,conical washer	See Note 1
20	1	Screw, Hex M8-1.25x20, STZP	See Note 1
21	2	Screw,PHCR,M5-.8x20mm,blinding	See Note 1
22	6	Screw,Hex HD,M5-1.4x13 STZC	See Note 1
23	8	Screw, PHCR, M5-.8x50, STZP	See Note 1
24	6	Screw, Hex HD,1/4-20x.5"	See Note 1
25	4	Screw, SHC, 1/4-20x5/8"	See Note 1
26	8	Screw,PHCR,M6-1.0x16mm,STZP	See Note 1
27	4	Screw, PHCR, #10-32x3/4"	See Note 1
28	1	Bracket, IGBT Fan,PM,IPS	830898
29	1	Heatsink,Output Diodes,PM,IPS	830896
30	1	Bracket,Diode Fan,PM,IPS	830806

Note 1:

This part is available at most hardware stores.



Art # A-06940

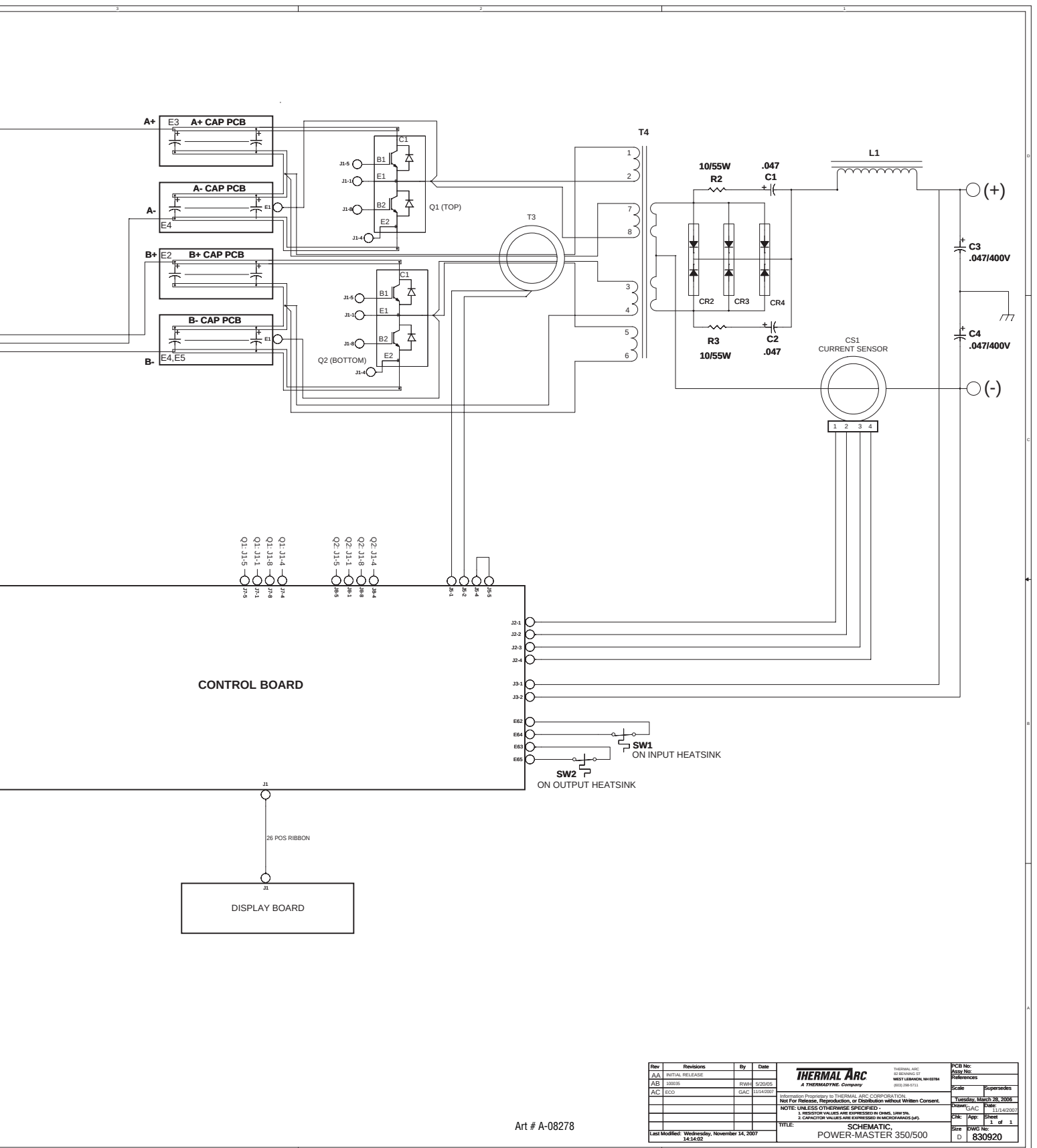


APPENDIX 1: GENERAL INFORMATION

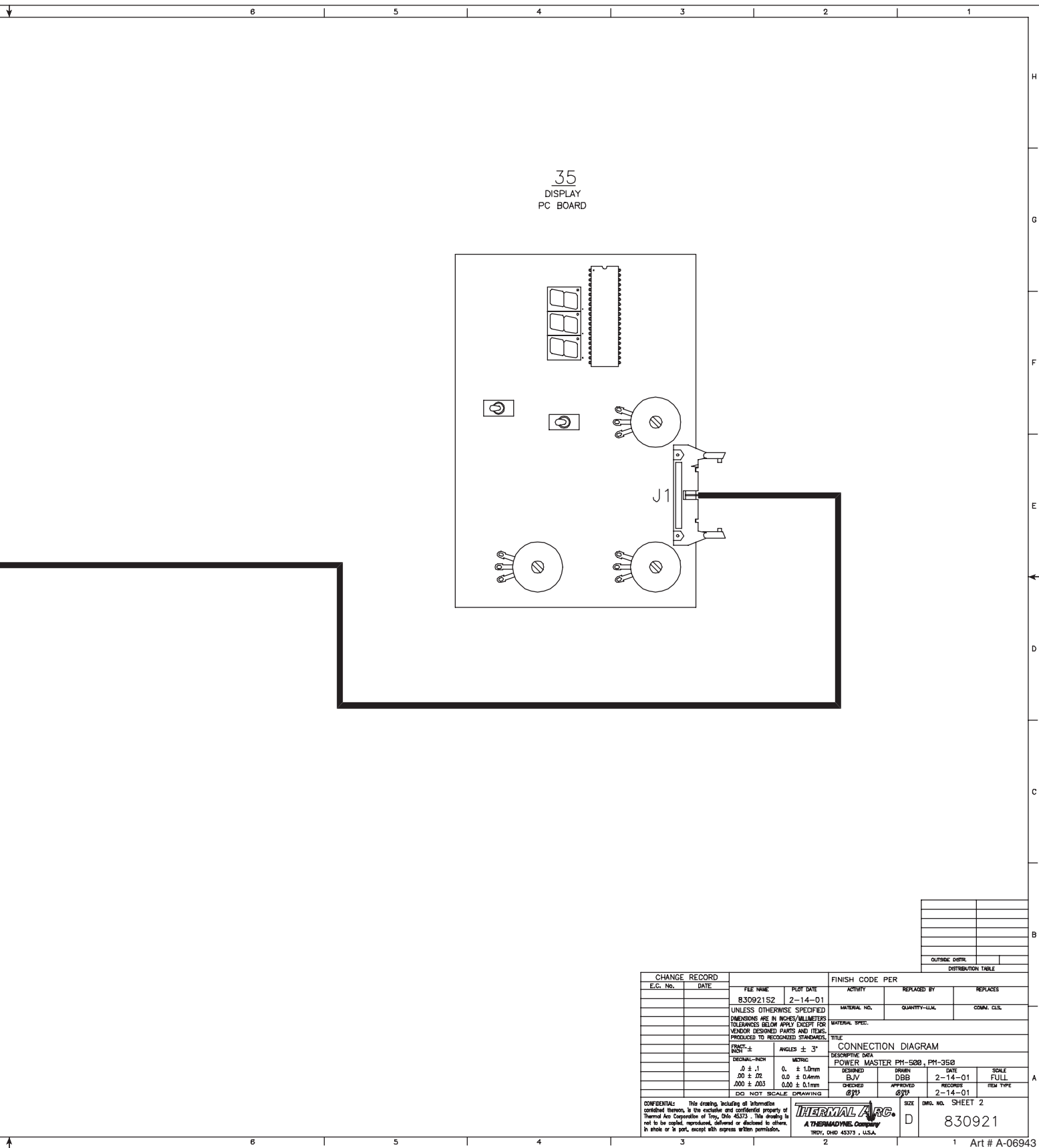
- Note the model and specification number shown on the equipment nameplate.
- Locate these numbers in the model and specification number columns below.
- Use only those diagrams and instructions that are applicable.

SPECIFICATION NUMBER	MODEL	SCHEMATIC AND CONNECTION DIAGRAM
100085	POWER-MASTER 500	830921 830920
100086	POWER-MASTER 500P	830924 830925
100078	POWER-MASTER 350	830921 830920
100079	POWER-MASTER 350P	830924 830925



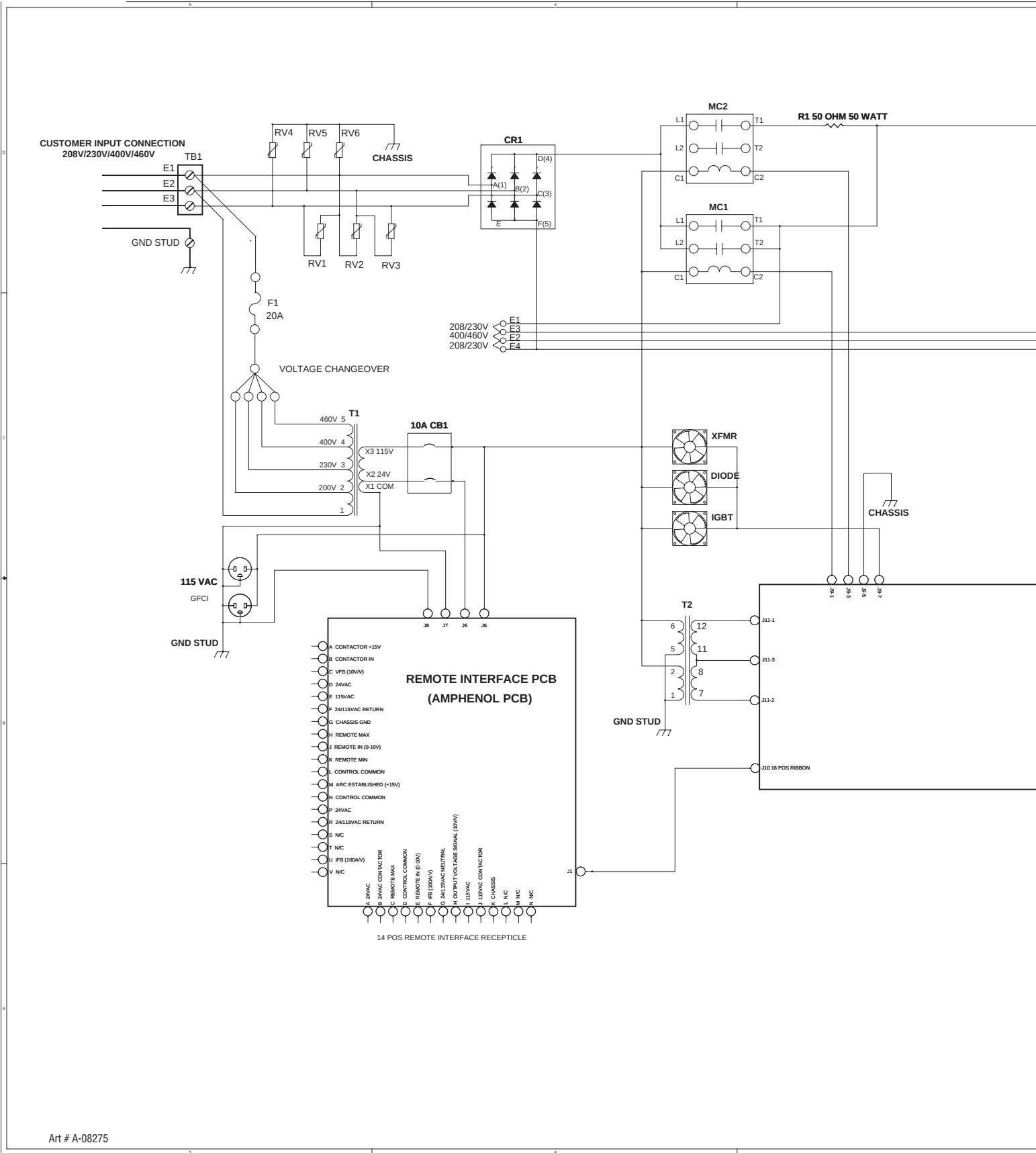




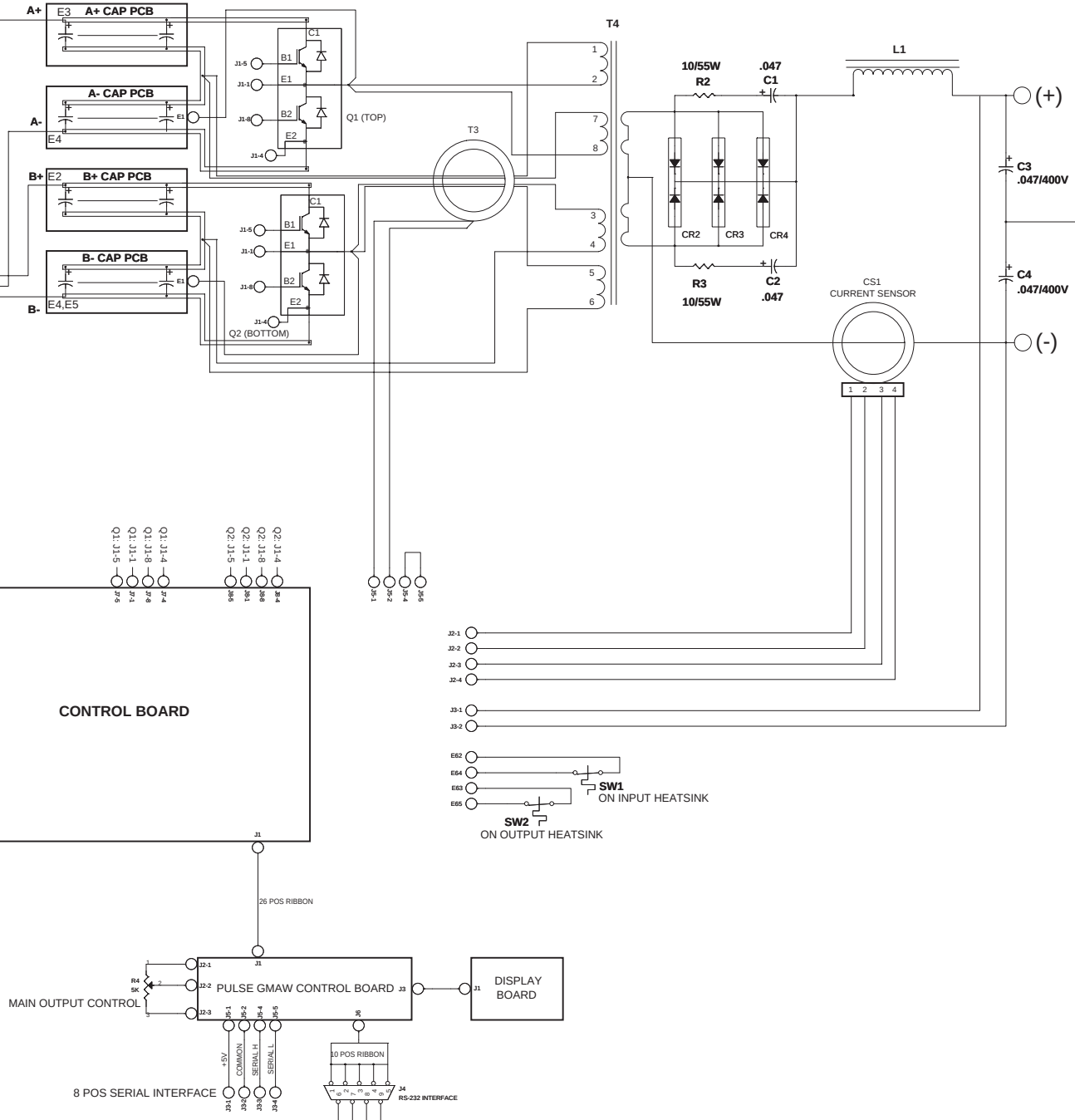


CHANGE RECORD		FINISH CODE PER			
E.C. No.	DATE	FILE NAME	PLT DATE	ACTIVITY	REPLACES
		830921S2	2-14-01		
		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES/MILLIMETERS TOLERANCES BELOW APPLY EXCEPT FOR PREFERRED TO RECOMMENDED STANDARDS.		MATERIAL NO.	QUANTITY-LLM
				MATERIAL SPEC.	CONV. CLS.
				TITLE	
				CONNECTION DIAGRAM	
				POWER MASTER PM-500, PM-350	
				DESIGNED	DATE
				BJV	2-14-01
				APPROVED	SCALE
				BJV	FULL
				RECORDED	ITEM TYPE
				2-14-01	
				Dwg. No. SHEET 2	
				830921	
				Art # A-06943	

APPENDIX 4: PM-500P SCHEMATIC DIAGRAM



Art # A-08275

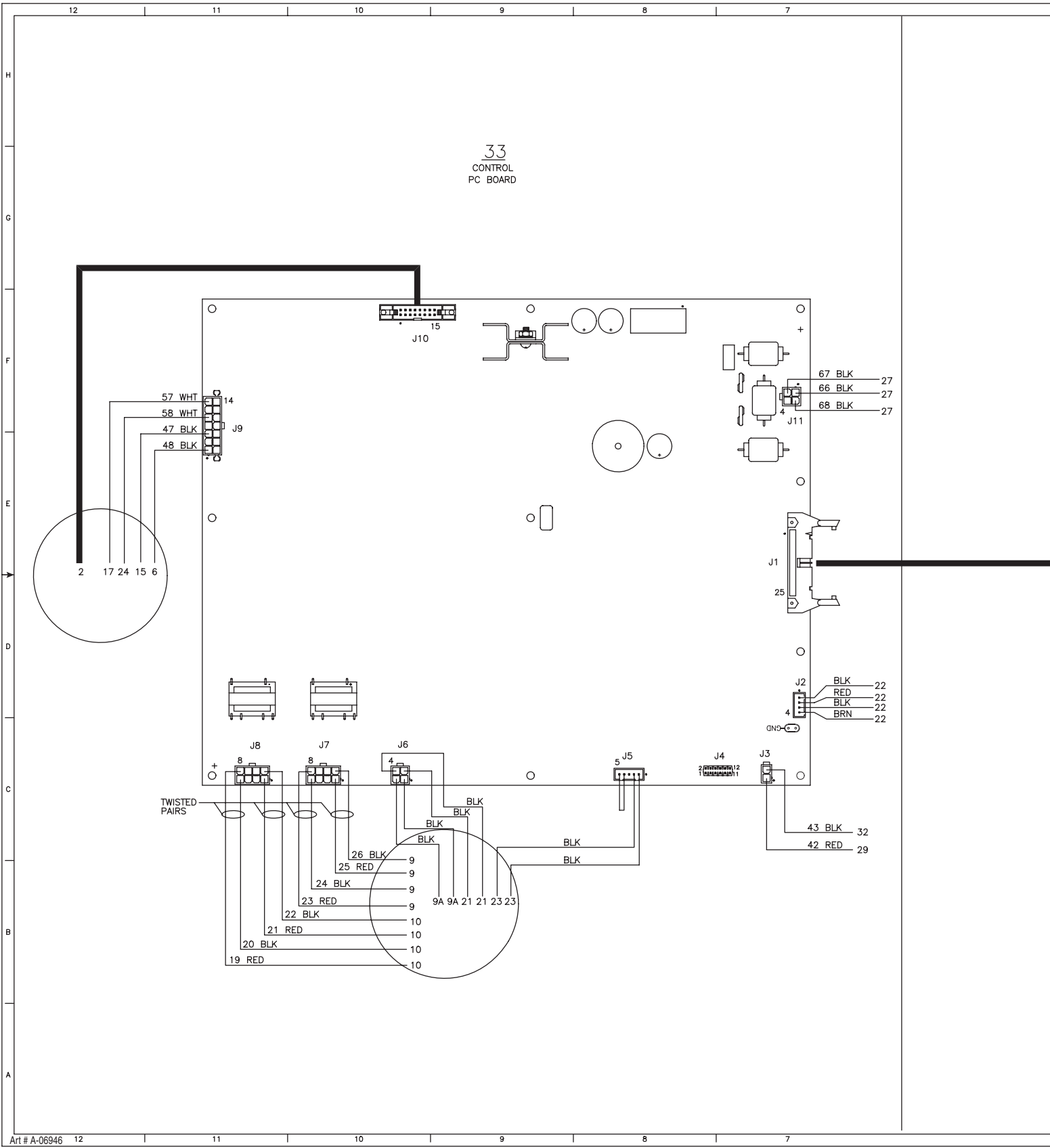


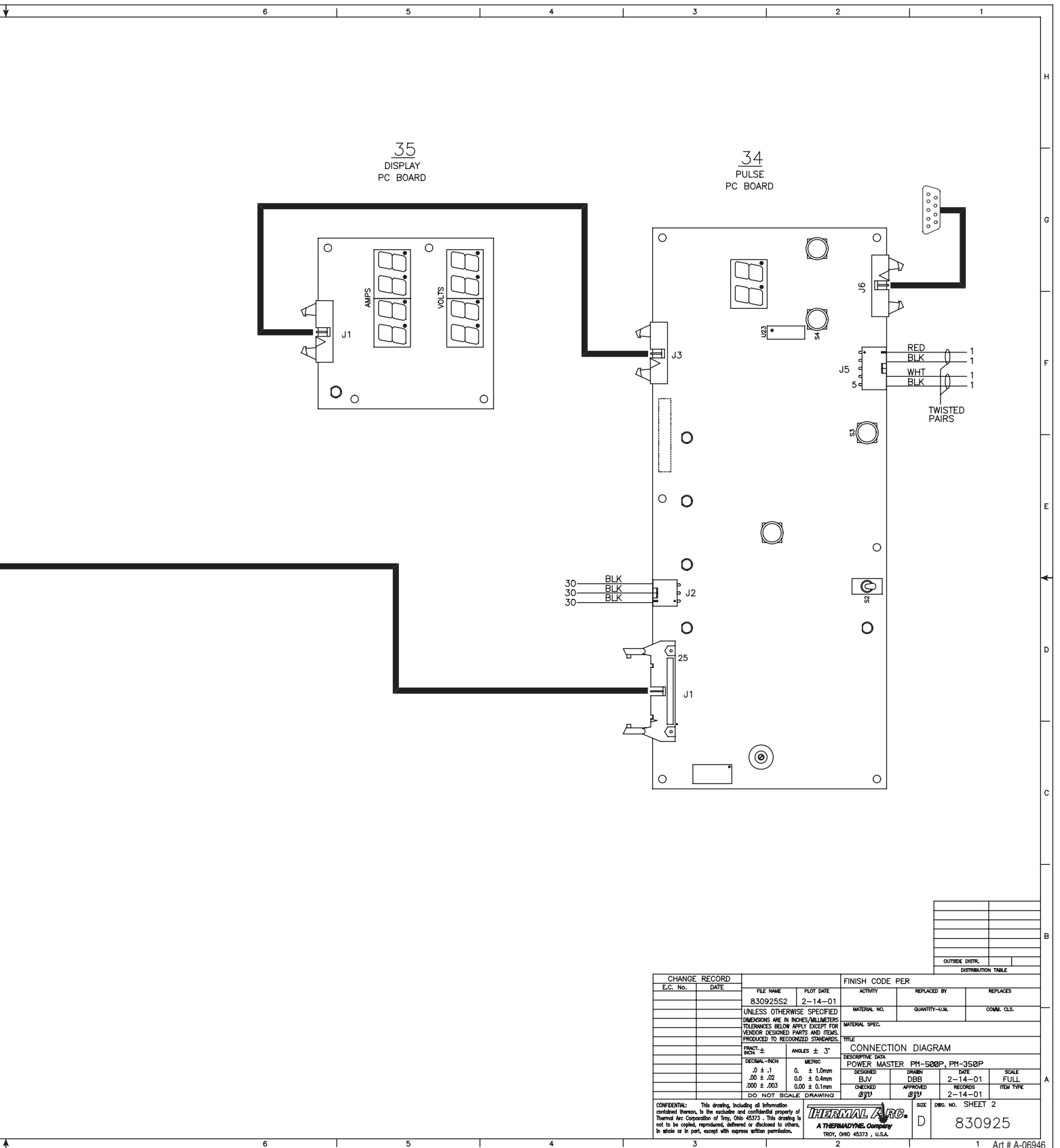
Art # A-08275

Rev	Revisions	By	Date	THERMAL ARC		PCR No.
AA	INITIAL RELEASE ECO-10003	RS	05/21/06	THERMAL ARC		Assy No.
AB	ECO-8359	RWD	02/06/07	WEST LEBANON, NH 03784		References
AC	ECO	GAC	10/31/07	8309-010		Scale
				Information Proprietary to THERMAL ARC CORPORATION.		Transfer, March 28, 2008
				Not For Release, Reproduction, or Distribution without Written Consent.		Drawn: GAC
				NOTE: UNLESS OTHERWISE SPECIFIED -		Check: GAC
				1. RESISTOR VALUES ARE EXPRESSED IN OHMS, UNLESS		App: Sheet
				2. CAPACITOR VALUES ARE EXPRESSED IN MICROFARADS (UF).		1 of 1
				TITLE: SCHEMATIC,		Size: D
				POWER-MASTER 500P		DWG No: 830924

POWERMASTER 500, 500P, 350, 350P

APPENDIX 5: PM500P/350P CONNECTION DIAGRAM - 2 OF 2





LIMITED WARRANTY

This information applies to Thermal Arc products that were purchased in the USA and Canada.

November 2007

LIMITED WARRANTY: Thermal Arc[®], Inc., A Thermadyne Company ("Thermal Arc"), warrants to customers of authorized distributors ("Purchaser") that its products will be free of defects in workmanship or material. Should any failure to conform to this warranty appear within the warranty period stated below, Thermal Arc shall, upon notification thereof and substantiation that the product has been stored, installed, operated, and maintained in accordance with Thermal Arc's specifications, instructions, recommendations and recognized standard industry practice, and not subject to misuse, repair, neglect, alteration, or damage, correct such defects by suitable repair or replacement, at Thermal Arc's sole option, of any components or parts of the product determined by Thermal Arc to be defective.

This warranty is exclusive and in lieu of any warranty of merchantability, fitness for any particular purpose, or other warranty of quality, whether express, implied, or statutory.

Limitation of liability: Thermal Arc shall not under any circumstances be liable for special, indirect, incidental, or consequential damages, including but not limited to lost profits and business interruption. The remedies of the purchaser set forth herein are exclusive, and the liability of Thermal Arc with respect to any contract, or anything done in connection therewith such as the performance or breach thereof, or from the manufacture, sale, delivery, resale, or use of any goods covered by or furnished by Thermal Arc, whether arising out of contract, tort, including negligence or strict liability, or under any warranty, or otherwise, shall not exceed the price of the goods upon which such liability is based.

No employee, agent, or representative of Thermal Arc is authorized to change this warranty in any way or grant any other warranty, and Thermal Arc shall not be bound by any such attempt. Correction of non-conformities, in the manner and time provided herein, constitutes fulfillment of thermal's obligations to purchaser with respect to the product.

This warranty is void, and seller bears no liability hereunder, if purchaser used replacement parts or accessories which, in Thermal Arc's sole judgment, impaired the safety or performance of any Thermal Arc product. Purchaser's rights under this warranty are void if the product is sold to purchaser by unauthorized persons.

The warranty is effective for the time stated below beginning on the date that the authorized distributor delivers the products to the Purchaser. Notwithstanding the foregoing, in no event shall the warranty period extend more than the time stated plus one year from the date Thermal Arc delivered the product to the authorized distributor.

Warranty repairs or replacement claims under this limited warranty must be submitted to Thermal Arc via an authorized Thermal Arc repair facility within thirty (30) days of purchaser's discovery of any defect. Thermal Arc shall pay no transportation costs of any kind under this warranty. Transportation charges to send products to an authorized warranty repair facility shall be the responsibility of the Purchaser. All returned goods shall be at the Purchaser's risk and expense. This warranty dated July 1st 2007 supersedes all previous Thermal Arc warranties. Thermal Arc[®] is a Registered Trademark of Thermal Arc, Inc.

WARRANTY SCHEDULE

This information applies to Thermal Arc products that were purchased in the USA and Canada.

November 2007

<u>SAFETY EQUIPMENT</u>	<u>WARRANTY PERIOD</u>	<u>LABOR</u>
Auto-Darkening Welding Helmet (Electronic Lens)	1 year	1 year
Harness Assembly	1 Month	1 Month
<u>ENGINE DRIVEN WELDERS</u>	<u>WARRANTY PERIOD</u>	<u>LABOR</u>
Scout, Raider, Explorer		
Original Main Power Stators and Inductors.....	3 years	3 years
Original Main Power Rectifiers, Control P.C. Boards.....	3 years	3 years
All other original circuits and components including, but not limited to, relays, switches, contactors, solenoids, fans, power switch semi-conductors.....	1 year	1 year
Engines and associated components are NOT warranted by Thermal Arc, although most are warranted by the engine manufacturer.....	See the Engine Manufactures Warranty for Details	
<u>GMAW/FCAW (MIG) WELDING EQUIPMENT</u>	<u>WARRANTY PERIOD</u>	<u>LABOR</u>
Fabricator 131, 181; 140; 180; 190, 210, 251, 281; Fabstar 4030;		
PowerMaster 350, 350P, 500, 500P; 320SP; 400SP; 500SP; Excelarc 6045.		
Wire Feeders; Ultrafeed, Portafeed		
Original Main Power Transformer and Inductor	5 years	3 years
Original Main Power Rectifiers, Control P.C. Boards, power switch semi-conductors	3 years	3 years
All other original circuits and components including, but not limited to, relays, switches, contactors, solenoids, fans, electric motors.....	1 year	1 year
<u>GTAW (TIG) & MULTI-PROCESS INVERTER WELDING EQUIPMENT</u>	<u>WARRANTY PERIOD</u>	<u>LABOR</u>
160TS, 300TS, 400TS, 185AC/DC, 200AC/DC, 300AC/DC, 400GTSW, 400MST, 300MST, 400MSTP		
Original Main Power Magnetics.....	5 years	3 years
Original Main Power Rectifiers, Control P.C. Boards, power switch semi-conductors	3 years	3 years
All other original circuits and components including, but not limited to, relays, switches, contactors, solenoids, fans, electric motors.....	1 year	1 year
<u>PLASMA WELDING EQUIPMENT</u>	<u>WARRANTY PERIOD</u>	<u>LABOR</u>
Ultima 150		
Original Main Power Magnetics.....	5 years	3 years
Original Main Power Rectifiers, Control P.C. Boards, power switch semi-conductors	3 years	3 years
Welding Console, Weld Controller, Weld Timer.....	3 years	3 years
All other original circuits and components including, but not limited to, relays, switches, contactors, solenoids, fans, electric motors, Coolant Recirculator.....	1 year	1 year
<u>SMAW (Stick) WELDING EQUIPMENT</u>	<u>WARRANTY PERIOD</u>	<u>LABOR</u>
Dragster 85		
Original Main Power Magnetics.....	1 year	1 year
Original Main Power Rectifiers, Control P.C. Boards.....	1 year	1 year
All other original circuits and components including, but not limited to, relays, switches, contactors, solenoids, fans, power switch semi-conductors.....	1 year	1 year
160S, 300S, 400S		
Original Main Power Magnetics.....	5 years	3 years
Original Main Power Rectifiers, Control P.C. Boards.....	3 years	3 years
All other original circuits and components including, but not limited to, relays, switches, contactors, solenoids, fans, power switch semi-conductors.....	1 year	1 year
<u>GENERAL ARC EQUIPMENT</u>	<u>WARRANTY PERIOD</u>	<u>LABOR</u>
Water Recirculators.....	1 year	1 year
Plasma Welding Torches.....	180 days	180 days
Gas Regulators (Supplied with power sources)	180 days	Nil
MIG and TIG Torches (Supplied with power sources).....	90 days	Nil
Replacement repair parts.....	90 days	Nil
MIG, TIG and Plasma welding torch consumable items	Nil	Nil



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